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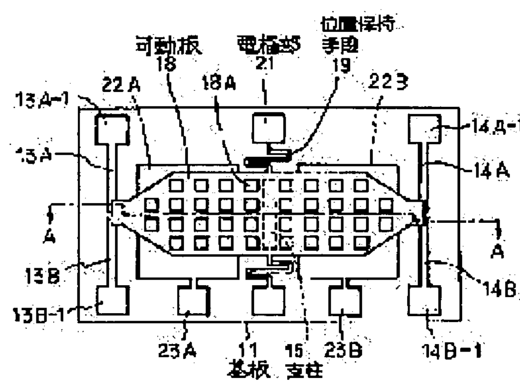
(54) INTEGRATED MICROSWITCH AND ITS MANUFACTURE

(57)Abstract:
PROBLEM TO BE SOLVED: To provide an integrated microswitch, capable of being turned on or off reliably even by small attraction force without causing a breakage accident of a moving plate by generating a force between one end of the moving plate supported in a seesaw-movable state by a support protruded on one face of a substrate and the substrate, and providing a fixed contact point contacted electrically or separated by a moving contact point fitted at the free end of the moving plate.
SOLUTION: When positive and negative voltages are applied to a moving plate 18 and a lower electrode 22A, attraction force is generated on the moving contact point side of the moving plate 18 by static electricity, and the moving contact point is brought into contact with fixed contact points 13A and 13B, therefore terminals 13A-1 and 13B-1 are set to a conducting state between them. When the voltages are applied to the moving plate 18 and a lower electrode 22B in reverse, attraction force is generated on the moving contact point side of the moving plate 18, and the moving contact point is brought into contact with fixed contact points 14A and 14B, therefore terminals 14A-1 and 14B-1 are set to a conducting state between them.



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CLAIMS

[Claim(s)]
[Claim 1] A. the stanchion projected and formed in one field of a substrate, and B. -- with the movable plate supported with this stanchion by the condition in which a seesaw movement is possible C. A station keeping means to connect between the both-sides side of the rotation supporting point of this movable plate, and substrates, enabling free rotation, D. The driving means to which either between one rotation one end of the above-mentioned movable plate and the above-mentioned substrate and between rotation one end of another side of the above-mentioned substrate and the above-mentioned substrate are made to generate the force, and the seesaw movement of the above-mentioned movable plate is carried out, E. Accumulation mold microswitch constituted as resemble the traveling contact with which the free end of the above-mentioned movable plate was equipped, and the stationary contact which attaches and detaches electrically by the F. above-mentioned traveling contact.
[Claim 2] The accumulation mold microswitch characterized by constituting the above-mentioned driving means in an accumulation mold microswitch according to claim 1 by the lower electrode arranged on the plate surface of the above-mentioned substrate at the position of symmetry bordering on the above-mentioned stanchion, and the movable plate to which predetermined potential is given with conductivity.
[Claim 3] The accumulation mold microswitch characterized by constituting the above-mentioned driving means in an accumulation mold microswitch according to claim 1 with the lower electrode arranged on the plate surface of the above-mentioned substrate at the position of symmetry bordering on the above-mentioned stanchion, and the up electrode which was formed at the above-mentioned movable plate, countered with the above-mentioned electrode, and has been arranged.
[Claim 4] The accumulation mold microswitch characterized by constituting in an accumulation mold microswitch according to claim 1 by two or more lower electrodes which have arranged the

above-mentioned driving means on the plate surface of the above-mentioned substrate at each of the position of symmetry bordering on the above-mentioned stanchion, and the movable plate.

[Claim 5] The accumulation mold microswitch characterized by constituting in an accumulation mold microswitch according to claim 1 with the flat flat-surface coil which formed the above-mentioned driving means in the position of symmetry bordering on the rotation supporting-point location of the above-mentioned movable plate in the plate surface of the above-mentioned movable plate, and the permanent magnet which gives the field of the direction which is parallel to the field which this flat-surface coil generates.
[Claim 6] The accumulation mold microswitch characterized by constituting with the coil which countered one side of the movable plate which formed the above-mentioned driving means by magnetic material, and this movable plate, and the both sides of rotation one end of another side in the accumulation mold microswitch according to claim 1, was laid under the above-mentioned substrate, and wound and constituted the wire rod in tubed.
[Claim 7] The accumulation mold microswitch characterized by constituting with the exiting coil which was held in the accumulation mold microswitch according to claim 1 at the movable plate which formed the above-mentioned driving means by magnetic material, and the accessory plate which countered one side of this movable plate, and the both sides of rotation one end of another side, and was constructed over the top face of the above-mentioned movable plate, and wound and constituted the wire rod in tubed.
[Claim 8] The accumulation mold microswitch characterized by constituting with the exiting coil of the pair which wound and constituted in tubed the wire rod which countered with the piece of magnetic adsorption formed with the magnetic substance of a pair with which the position of symmetry was equipped bordering on the rotation supporting-point location of the above-mentioned movable plate, and the piece of magnetic adsorption of this pair, and has arranged the above-mentioned driving means in an accumulation mold microswitch according to claim 1.
[Claim 9] The accumulation mold microswitch characterized by to constitute with the exiting coil of the pair which wound and constituted in tubed the wire rod which countered with the piece of magnetic adsorption of the pair by which it was equipped with the above-mentioned driving means by the position of symmetry bordering on the rotation supporting-point location of the above-mentioned movable plate, and the magnetic pole was magnetized in the thickness direction of the above-mentioned movable plate in the accumulation mold microswitch according to claim 1, and the piece of magnetic adsorption of this pair, and was laid under the above-mentioned substrate.
[Claim 10] The accumulation mold microswitch characterized by constituting with the hinge which connects between the bases which projected and formed the above-mentioned station keeping means outward in the accumulation mold microswitch according to claim 1 at the plate surface of the above-mentioned substrate from the both-sides side of the rotation supporting-point location of the above-mentioned movable plate, and in which elastic deformation is possible.
[Claim 11] The accumulation mold microswitch characterized by to constitute by the bearing formed on the base which was made to penetrate the support shaft which projected and formed the above-mentioned station-keeping means outward in the accumulation mold microswitch according to claim 1 from the both-sides side of the rotation supporting-point location of the above-mentioned movable plate, and this support shaft, was engaged, and was projected and formed from the plate surface of the above-mentioned substrate.
[Claim 12] It is the accumulation mold microswitch which the above-mentioned traveling contact carries out covering formation at the inferior-surface-of-tongue side of the rotation free end of the above-mentioned movable plate, and is characterized by making the above-mentioned stationary contact into the structure formed in the above-mentioned traveling contact on the above-mentioned substrate, and the location which counters in an accumulation mold microswitch according to claim 1.
[Claim 13] The accumulation mold microswitch characterized by giving the spring nature in which elastic deformation is possible to the above-mentioned traveling contact, and performing a self-

cleaning operation to the mutual between the above-mentioned traveling contact and a stationary contact by spring nature in an accumulation mold microswitch according to claim 1.
[Claim 14] The accumulation mold microswitch characterized by the structure which formed the above-mentioned traveling contact in the top-face side of the rotation free end of the above-mentioned movable plate, and equipped with the above-mentioned stationary contact the beam constructed over the location distant from the plate surface of the above-mentioned substrate in the accumulation mold microswitch according to claim 1.
[Claim 15] The accumulation mold microswitch characterized by the structure constituted with the conductor which constitutes the signal-transmission track adjusted by the above-mentioned stationary contact at the predetermined impedance in an accumulation mold microswitch according to claim 1.
[Claim 16] The accumulation mold microswitch characterized by the structure which constituted the above-mentioned stationary contact by the microstrip line in an accumulation mold microswitch according to claim 1.
[Claim 17] The accumulation mold microswitch characterized by the structure which constituted the above-mentioned stationary contact by the KOPURENA mold microstrip line in an accumulation mold microswitch according to claim 1.
[Claim 18] A. the stationary contact formed in one field of a substrate, and B. -- the cantilever which it countered with this stationary contact, the rotation free end has been arranged, and the other-end side was fixed to the substrate, and was formed with the conductor, and C. -- the accumulation mold microswitch characterized by to constitute "resemble the exiting coil which countered with the above-mentioned rotation free end of this cantilever, has been arranged, and wound and constituted the wire rod in tubed."
[Claim 19] A. The movable plate which was formed of the magnetic material which has conductivity and was supported by one field of a substrate with the structure of a cantilever, B. The cantilever for stationary-contact support formed in the location which countered with the rotation free end of this movable plate, and was slightly separated from the rotation free end of a movable plate with the non-magnetic material which supports a stationary contact, C. Accumulation mold microswitch characterized by constituting "Resemble the exiting coil which countered with the rotation free end of the above-mentioned movable plate, has been arranged, and wound and constituted the wire rod in tubed."
[Claim 20] While supporting the core of a polygonal movable plate with a stanchion, counter with this movable plate and a lower electrode is arranged in the lower part of a substrate. Form a traveling contact in each corner of a movable plate, form an up electrode in each top-face side of each corner of a movable plate, and an electrical potential difference is impressed to this up electrode and the above-mentioned lower inter-electrode one. The accumulation mold microswitch characterized by having carried out the variation rate of the part of the corner of the above-mentioned movable plate toward the substrate, and considering as the structure of making the stationary contact which formed in the substrate the traveling contact formed in each corner contacting, and making a stationary contact attaching and detaching.
[Claim 21] The accumulation mold microswitch characterized by the structure which formed two or more accumulation mold microswitches in the common substrate in an accumulation mold microswitch according to claim 1.
[Claim 22] The accumulation mold microswitch characterized by having set they being [any of claims 1, 18, and 19 and the accumulation mold microswitch of 20 publications], having enclosed the above-mentioned accumulation mold microswitch with the hermetic container, and filling up with and constituting inert gas in a hermetic container.
[Claim 23] A. The process which forms the lower electrode of a pair, and a stationary contact in one field of a substrate, B. The process which forms a stanchion in the gap which counters mutually [the lower electrode of this pair], C. The sacrifice layer formed with the quality of the material which can have thickness almost equal to the height of the above-mentioned stanchion, and can be removed with an etching reagent, D. The process which forms in the front face of this sacrifice layer the traveling contact with which the free end of a movable plate should be equipped, E. The process which forms the insulating layer for insulating between a traveling

contact and movable plates, F. The process which forms in the top face of this insulating layer the movable plate, the hinge, and the hole for etching which consist of conductive ingredients, G. The manufacture approach of the process which removes the insulating layer formed between the above-mentioned stanchion and the movable plate between the above-mentioned movable plate and the sacrifice layer through the hole for etching formed in the above-mentioned movable plate, the etching process which removes the H. above-mentioned sacrifice layer, and the accumulation mold microswitch characterized by manufacturing "Be alike."

[Claim 24] A. The part which should form the lower electrode of a pair in one field of a substrate, and the part which should form a stanchion, The process which forms a metal layer in the part which should form the base used as bearing, and the part which should form a fixed electrode, B. The process which forms the deposit which has predetermined thickness in the part which should form the above-mentioned stanchion, and the part which should form a base, and forms a stanchion and a base, C. The 1st sacrifice layer which had thickness equivalent to the above-mentioned stanchion and a base, was made to expose the front face of the above-mentioned stanchion and a base, and was formed, D. The process which counters the front face of this 1st sacrifice layer mostly in the location of the above-mentioned fixed electrode, and carries out covering formation of the traveling contact, E. The process which forms the 2nd sacrifice layer which forms the front face of the above-mentioned 1st sacrifice layer in a flat side where the front face of this traveling contact is exposed, F. The process which forms a conductive layer on the field which this 2nd sacrifice layer and traveling contact form, G. The process which forms the hole of the pair for forming bearing in the location of the above-mentioned base to each of this conductive layer and the above-mentioned 2nd sacrifice layer, H. The process which leaves the configuration of the support shaft which the above-mentioned conductive layer is made to project from a movable plate and this movable plate, and forms it, and removes others, I. The process which carries out covering formation of the resist layer with thickness almost equal to the part from which the above-mentioned conductive layer was removed in the thickness of a movable plate, J. The process which forms the deposit which has predetermined thickness in the front face of the above-mentioned base exposed through the front face and the above-mentioned hole of the above-mentioned conductive layer which were exposed to the field surrounded in the above-mentioned resist layer, and forms a part for the pillar section of a movable plate, a support shaft, and bearing, K. The process which forms the 3rd sacrifice layer on the flat surface formed on the front face for a pillar section of the above-mentioned resist layer, a movable plate, a support shaft, and bearing, L. The process which forms the hole to which it is formed in this 3rd sacrifice layer, and the front face for a pillar section of the above-mentioned bearing is exposed, M. The process which forms a conductive layer in the interior of this hole, and the front face of the above-mentioned 3rd sacrifice layer, N. The process which forms the 4th sacrifice layer which has predetermined thickness in the top face of this conductive layer, O. The process which forms the long hole which connects a part for the pillar section of the above-mentioned bearing with this 4th sacrifice layer, P. The process which forms the deposit which is exposed to the interior of this long hole, and has desired thickness in the front face of a conductive layer, and completes bearing, Q. by removing the process which removes the 4th sacrifice layer after completion of the above-mentioned bearing and the process which removes the above-mentioned conductive layer by which this 4th sacrifice layer was removed and exposed, and a conductive layer The manufacture approach of the accumulation mold microswitch characterized by including the process which removes the process which removes a movable plate and a support shaft, and the resist layer that enclosed and formed a part for the pillar section of bearing, the 2nd sacrifice layer formed between the movable plate and the substrate, and the 1st sacrifice layer.

[Claim 25] A. the process which forms the lower electrode of a pair in one field of a substrate, and B. -- with the process which forms a stanchion in the gap which counters mutually [the lower electrode of this pair] C. The process which forms the insulating layer which has thickness almost equal to the position of symmetry in the height of the above-mentioned stanchion mutually on both sides of the above-mentioned stanchion, D. The process which forms the stationary contact of a pair in the top face of this insulating layer, and the process which

forms the 1st sacrifice layer which has thickness almost equal in the height of the above-mentioned stanchion between the E. above-mentioned insulating layers, F. The process which forms the resin layer which can be etched into the top face of this 1st sacrifice layer, G. The process which forms the hinge extended from the both-sides location which counters to a movable plate and the above-mentioned stanchion of this movable plate, and outwardness in the top face of this resin layer, H. The process which removes the resin layer formed between the above-mentioned 1st sacrifice layer and the movable plate, and forms an opening between the above-mentioned stanchion and a movable plate, I. The process which forms the 2nd sacrifice layer almost equal to the thickness of the above-mentioned movable plate in the top face of the insulating layer in which the above-mentioned stationary contact was formed, J. The process which forms the up electrode of a pair in the top face of the above-mentioned movable plate mutually from the above-mentioned stanchion at the equal position of symmetry, The edge of the process which forms in the top face of the above-mentioned hinge wiring which besides supplies a voltage signal to a section electrode, and the above-mentioned movable plate, the process which forms a traveling contact ranging over the above-mentioned 2nd sacrifice layer, and the process which removes the 1st sacrifice layer of K. above, and the 2nd sacrifice layer -- since -- the manufacture approach of the accumulation mold microswitch characterized by changing.

[Claim 26] A. the process which forms a stanchion in one field of a substrate, and B. -- with the process which forms the stationary contact of the pair arranged to the position of symmetry on both sides of this stanchion C. The process which forms the sacrifice layer possessing thickness almost equal to the height of the above-mentioned stanchion, D. The process which forms a removal layer with the ingredient which can be etched on this sacrifice layer, E. The process which forms a movable plate and a hinge in piles on this removal layer, F. The process which forms the 2nd sacrifice layer possessing thickness almost equal to a movable plate in the location in which the above-mentioned stationary contact was formed, G. The process which forms a traveling contact in each of the process which forms a flat-surface coil in the position of symmetry on both sides of the above-mentioned stanchion of the top face of the above-mentioned movable plate, and the flat-surface coil of this pair ranging over both the free ends and the above-mentioned 2nd sacrifice layers of the process which forms wiring which supplies a current, and the above-mentioned movable plate, H. The manufacture approach of the process which removes the above-mentioned removal layer and separates the above-mentioned stanchion and a movable plate, the process which removes the 1st sacrifice layer of I. above, and the 2nd sacrifice layer, and the accumulation mold microswitch characterized by changing more.

[Claim 27] A. Wind a wire rod around this hole tubed, and it is constituted. the process which forms a hole in one field of a substrate, and B. -- The process with which the terminal of both wire rods is equipped with an electrode, the sense to which the longitudinal direction of the after-mentioned movable plate and the above-mentioned electrode cross at right angles is made to arrange the exiting coil arranged to one end face of the coil which wound this electrode around tubed, and it loads, C. The process which applies resin material to the top face of this exiting coil, and the top face of the above-mentioned substrate, forms a resin layer, is made to solidify this resin layer, and fixes the above-mentioned exiting coil to the interior of the above-mentioned hole, D. The process which carries out cutting of the electrode with which the front face and the above-mentioned exiting coil of the above-mentioned resin layer were equipped, and carries out mirror plane finishing of the front face of a resin layer, E. Wiring which contacts the electrode of the above-mentioned exiting coil on the front face of the resin layer by which mirror plane finishing was carried out, The part which should form the stanchion for carrying out the seesaw movement of the electrode for impressing a current to this wiring, a stationary contact, and the after-mentioned movable plate, The process which forms the deposit which has predetermined thickness in the process which forms a metal layer in the part which should project and should form the base used as bearing, the part which should form the F. above-mentioned stanchion, and the part which should form a base, and forms a stanchion and a base, G. The 1st sacrifice layer which had thickness equivalent to the above-mentioned stanchion and

a base, was made to expose the front face of the above-mentioned stanchion and a base, and was formed, H. The process which counters the front face of this 1st sacrifice layer mostly in the location of the above-mentioned fixed electrode, and carries out covering formation of the traveling contact, I. The process which forms the 2nd sacrifice layer which forms the front face of the above-mentioned 1st sacrifice layer in a flat side where the front face of this traveling contact is exposed, J. The process which forms a conductive layer on the field which this 2nd sacrifice layer and traveling contact form, K. The process which forms the hole of the pair for forming bearing in the location of the above-mentioned base to each of this conductive layer and the above-mentioned 2nd sacrifice layer, L. The process which leaves the configuration of the support shaft which the above-mentioned conductive layer is made to project from a movable plate and this movable plate, and forms it, and removes others, M. The process which carries out covering formation of the resist layer with thickness almost equal to the part from which the above-mentioned conductive layer was removed in the thickness of a movable plate, N. The process which forms the deposit which has predetermined thickness in the front face of the above-mentioned base exposed through the front face and the above-mentioned hole of the above-mentioned conductive layer which were exposed to the field surrounded in the above-mentioned resist layer, and forms a part for the pillar section of a movable plate, a support shaft, and bearing, O. The process which forms the 3rd sacrifice layer on the flat surface formed on the front face for a pillar section of the above-mentioned resist layer, a movable plate, a support shaft, and bearing, P. The process which forms the hole to which it is formed in this 3rd sacrifice layer, and the front face for a pillar section of the above-mentioned bearing is exposed, Q. The process which forms a conductive layer in the interior of this hole, and the front face of the above-mentioned 3rd sacrifice layer, R. The process which forms the 4th sacrifice layer which has predetermined thickness in the top face of this conductive layer, S. The process which forms the long hole which connects a part for the pillar section of the above-mentioned bearing with this 4th sacrifice layer, T. The process which forms the deposit which is exposed to the interior of this long hole, and has desired thickness in the front face of a conductive layer, and completes bearing, U. by removing the process which removes the 4th sacrifice layer after completion of the above-mentioned bearing and the process which removes the above-mentioned conductive layer by which this 4th sacrifice layer was removed and exposed, and a conductive layer The manufacture approach of the accumulation mold microswitch characterized by including the process which removes the process which removes a movable plate and a support shaft, and the resist layer that enclosed and formed a part for the pillar section of bearing, the 2nd sacrifice layer formed between the movable plate and the substrate, and the 1st sacrifice layer.

[Translation done.]

DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]

[Field of the Invention] About the accumulation mold microswitch which can be made by the manufacturing technology of a semiconductor integrated circuit, this invention carries out rotation actuation of the movable plate according to the suction force or electromagnetic force especially by static electricity, and proposes the accumulation mold microswitch and its manufacture approach of the structure of making the stationary contact which formed in the substrate the traveling contact with which the rotation free end of this movable plate was equipped attaching and detaching.
[0002]
[Description of the Prior Art] The highly efficient miniature switch which can be used from a direct current to ultrahigh frequency with advanced features of a measuring instrument or various kinds of test systems has come to be used in large quantities. Moreover, inclusion of the miniature switch of high performance is demanded also of the passive circuit elements handling the signal to microwave or a millimeter wave of an integrated circuit (Following MMIC is called). The solid state switch component which used FET or diode of silicon or a gallium arsenide semiconductor is conventionally used abundantly for this demand. Since a solid state switch component does not have a mechanical drive part, its reliability is high, and since a phot lithography techniques are used, it has the description which can form the thing of a small and uniform property in large quantities.
[0003] However, since a switch, on the other hand, cannot make on resistance in the condition of ON small enough, there is a fault with a large insertion loss. Moreover, since a switch cannot make electrostatic capacity in the condition of OFF small enough, there is also a fault with a bad separation property. The switch of this point mechanical contact structure has the high description also for degree of separation small [disadvantage ON loss]. For this reason, the manufacture approaches of an accumulation mold microswitch of having applied the manufacturing technology of a semiconductor integrated circuit are various attempt ********.
[0004] The structure of the accumulation mold microswitch by which the conventional proposal is made is shown in drawing 49 and drawing 50 . The accumulation mold microswitch considered conventionally For example, while forming a crevice 2 in a semi-conductor substrate 1 like silicon and forming the lower electrode 3 in the base of this crevice 2 By constructing a cantilever 4 over the effective area of a crevice 2, forming the up electrode 5 in the top face of a cantilever 4, and impressing forward and a negative unlike-pole electrical potential difference between these lower electrode 3 and the up electrode 5 Generate an electrostatic suction force between the lower electrode 3 and the up electrode 5, and the free end of a cantilever 4 is moved to it toward the base of a crevice 2 with this suction force. It considers as the structure to which contact the traveling contact 6 with which the free end was equipped to stationary contacts 7 and 8, make it flow through between stationary contacts 7 and 8, and a contact signal is made to send by this migration.
[0005] In addition, a cantilever 4 can remove the sacrifice layer which formed the sacrifice layer (not especially shown) in the crevice 2, formed the resin layer with suitable elasticity ranging over the top face of this sacrifice layer, and the top face of the semi-conductor substrate 1, formed the U-shaped cut groove 9 (refer to drawing 49) in this resin layer, and was formed in the crevice 2 through this cut groove 9 by etching etc., and can form a cantilever 4.
[0006]
[Problem(s) to be Solved by the Invention] The rate in which the accident which a problem is in the endurance of a cantilever 4, the force of the return of a cantilever becomes weak or a cantilever 4 breaks since it is the structure of equipping a cantilever 4 with a traveling contact 6 conventionally, carrying out elastic deformation of the cantilever 4, and contacting a traveling contact 6 to stationary contacts 7 and 8 as mentioned above, and is left with between [being in the condition of ON] stationary contacts 7 and 8 occurs is high. In order to raise the endurance of a cantilever 4, taking the thickness of a cantilever 4 thickly is also considered, but if the thickness of a cantilever 4 is taken thickly, un-arranging [to which it becomes difficult to carry out elastic deformation of the cantilever with the suction force by electrostatic force] will arise. Moreover, the contact pressure to a traveling contact 6 and stationary contacts 7 and 8 and the fault to which it becomes small and the stability of contact worsens are produced.

[0007] The purpose of this invention tends to offer the accumulation mold microswitch which the breakage accident of a movable plate cannot occur, and can send the contact signal of ON and OFF certainly also with a suction force small moreover, and can also obtain contact pressure greatly.
[0008]
[Means for Solving the Problem] The accumulation mold microswitch proposed by claim 1 of this invention The stanchion projected and formed in one field of a substrate, and the movable plate supported with this stanchion by the condition in which a seesaw movement is possible, The accumulation mold microswitch constituted as be alike is proposed as the driving means which generates the force between one side of this movable plate, and a substrate, and carries out the seesaw movement of the movable plate to it, the traveling contact with which the free end of a movable plate was equipped, and the stationary contact which attaches and detaches electrically by the traveling contact.
[0009] The accumulation mold microswitch proposed by claim 2 of this invention thru/or 9 charges the driving means of the accumulation mold microswitch proposed by claim 1 according to each format. The point which constituted the driving means from a claim 2 by the lower electrode formed in the substrate and the movable plate constituted with the conductor is charged. That is, by [fixed to a movable plate] impressing forward potential, for example and impressing negative potential to one side and another side of a lower electrode by turns, the seesaw movement of the movable plate is carried out according to electrostatic force, and a stationary contact attaches and detaches electrically by the traveling contact.
[0010] While an insulator constitutes a movable plate from claim 3, an up electrode is formed in the position of symmetry bordering on the rotation supporting point of this movable plate, and a fixed electrode is formed also in a substrate side bordering on a stanchion at the position of symmetry. The seesaw movement of the movable plate can be carried out, and between stationary contacts can be made to attach and detach electrically by this seesaw movement by impressing the potential of heteropolarity between an up electrode and a lower electrode. In claim 4, the accumulation mold microswitch of the electrostatic drive mold considered as the configuration which generates an electrostatic suction force is proposed by countering with one side of a movable plate, and the both sides of each rotation free end of another side, forming two or more lower electrodes in a substrate, forming electrostatic capacity between this two or more lower electrodes and movable plate, and charging a charge at this electrostatic capacity.
[0011] The driving means proposed by claim 5 of this invention charges the point constituted with the flat-surface coil formed in the position of symmetry bordering on the rotation supporting point of a movable plate, and the permanent magnet which generates the field which this flat-surface coil generates, and a parallel field. Even if the field generated from a flat-surface coil by using a permanent magnet as a field generating means is minute, a big suction force and big repulsive force can be acquired. The accumulation mold microswitch by which the contact condition of a stationary contact and a traveling contact was stabilized as this result can be offered.
[0012] The driving means proposed by claim 6 of this invention charges the accumulation mold microswitch constituted with the movable plate constituted with the magnetic substance, and the exiting coil which wound and constituted the wire rod in tubed. Many the number of winding can be taken by winding a wire rod around tubed. Since a magnetic suction force or magnetic repulsive force strong as this result can be acquired, the contact condition between a traveling contact and a stationary contact is stabilized also in this case, and an accumulation mold microswitch can be offered.
[0013] The accessory plate which constructed over the upper part side of a movable plate the exiting coil which wound and constituted the wire rod in tubed is made to support the driving means proposed by claim 7 of this invention, and the accumulation mold microswitch considered as the configuration which gives a suction force from the upper part side of a movable plate is proposed. The accumulation mold microswitch proposed by claim 8 of this invention equips with the piece of magnetic adsorption which changes from the magnetic substance to a movable plate, and proposes the point which constituted the driving means which generates magnetic

adsorption power by the field generated from an exiting coil by this piece of magnetic adsorption while it forms a movable plate with non-magnetic material.
[0014] In claim 9 of this invention, the magnetic pole of the thickness direction of a movable plate is magnetized to the piece of magnetic adsorption proposed by claim 8, and the driving means made into the structure of obtaining powerful contact pressure (contact pressure given between a traveling contact and a stationary contact) according to the synergism of the field of the piece of magnetic adsorption and the field of an exiting coil is proposed. Claims 10 and 11 of this invention propose the configuration of a station keeping means to hold the location of a movable plate. In claim 10, between the bases which were made to project from the both-sides side of the rotation supporting-point location of a movable plate and the plate surface of a substrate, and were formed is connected with the hinge in which elastic deformation is possible, with this hinge, a seesaw movement is possible in a movable plate, and the station keeping means made into the structure where a location gap moreover is not generated is proposed.
[0015] The station keeping means made into the structure which the bearing formed on the base which projected and formed the support shaft from the both-sides side of the rotation supporting-point location of a movable plate in this claim 11, and this support shaft was made to project from the plate surface of a substrate, and formed it is made to penetrate, and is made to hold is proposed. In claim 12 of this invention thru/or 17, it has proposed about the structure of a stationary contact and a traveling contact. In claim 12, covering formation of the traveling contact is carried out at the inferior-surface-of-tongue side of the rotation free end section of a movable plate, a stationary contact is formed on the plate surface of a substrate, and the accumulation mold microswitch considered as the configuration which detaches between stationary contacts electrically by the traveling contact is proposed.
[0016] In claim 13, the spring nature in which elastic deformation is possible is given to a traveling contact, and the accumulation mold microswitch made into the structure of performing a self-cleaning operation between a traveling contact and a stationary contact by this spring nature is proposed. In claim 14, it forms in the top-face side of the rotation free end of a movable plate, and the accumulation mold microswitch of structure with which the beam which constructed the stationary contact over the location distant from the plate surface of a substrate was equipped is proposed.
[0017] The accumulation mold microswitch constituted with the conductor which constitutes the signal-transmission track adjusted by the predetermined impedance in the stationary contact from a claim 15 is proposed. In claim 16, the configuration limited to the microstrip line as a concrete configuration of the signal-transmission track adjusted by the predetermined impedance is proposed. Moreover, the accumulation mold microswitch which constituted the stationary contact from a claim 17 by the KOPURENA mold microstrip line is proposed.
[0018] The advantage which can carry out continuation control is acquired without reducing wave-like quality also by the RF signal by having constituted the stationary contact from a signal-transmission track by which impedance matching was carried out according to the accumulation mold microswitch proposed by these claims 15 thru/or 17. It counters with the cantilever which it countered with the stationary contact formed in one field of a substrate in claim 18 of this invention, and this stationary contact, the rotation free end has been arranged, and the other end side was fixed to the substrate, and was formed with the conductor, and the rotation free end of this cantilever, and is arranged, and the accumulation mold microswitch constituted as resemble the exiting coil which wound and constituted the wire rod in tubed is proposed.
[0019] The movable plate which was formed in claim 19 of this invention of the magnetic material which has conductivity, and was supported by one field of a substrate with the structure of a cantilever, The cantilever for stationary-contact support formed in the location which countered with the rotation free end of this movable plate, and was slightly separated from the rotation free end of a movable plate with the nonmagnetic conductor which supports a stationary contact, It counters with the rotation free end of a movable plate, and is arranged, and the accumulation mold microswitch constituted as resemble the exiting coil which wound and constituted the wire rod in tubed is proposed.

[0020] In claim 20 of this invention, while supporting the core of a polygonal movable plate with a stanchion Counter with this movable plate, arrange a lower electrode in the lower part of a substrate, form a traveling contact in each corner of a movable plate, form an up electrode in each top-face side of each corner of a movable plate, and an electrical potential difference is impressed to this up electrode and the above-mentioned lower inter-electrode one. The part of the corner of the above-mentioned movable plate is made to change toward a substrate, and the accumulation mold microswitch made into the structure of making the stationary contact which formed in the substrate the traveling contact formed in each corner contacting, and making a stationary contact attaching and detaching is proposed.
[0021] In claim 21, two or more accumulation mold microswitches are formed in a common substrate, and the compound-ized accumulation mold microswitch is proposed. In claim 22, an accumulation mold microswitch is enclosed with a hermetic container, and the accumulation mold microswitch which filled up with and constituted inert gas in the hermetic container is proposed. Claim 23 of this invention thru/or 27 propose the manufacture approach of the accumulation mold microswitch of various kinds of above-mentioned structures.
[0022] In claim 23, the manufacture approach shown in drawing 5 is proposed. In claim 24, the manufacture approach of the accumulation mold microswitch of structure using bearing as a station keeping means shown in drawing 25 thru/or drawing 28 is proposed. In claim 25, the manufacture approach of an accumulation mold microswitch of having provided the traveling contact in which the elastic deformation shown in drawing 17 is possible is proposed. In claim 26, the manufacture approach of an accumulation mold microswitch of having provided the flat-surface coil shown in drawing 30 thru/or drawing 32 is proposed.
[0023] In claim 27, the manufacture approach of the accumulation mold microswitch equipped with the exiting coil shown in drawing 38 and drawing 39 is proposed.
[0024]
[work --] for Since according to the accumulation mold microswitch by this invention a traveling contact is actually driven and intermittence actuation of between stationary contacts is electrically carried out according to the suction force or electromagnetic force of static electricity as explained above, the on resistance at the time of a flow is small, and can acquire a good contact signal with the large off resistance at the time of opening. Moreover, since it considered as the structure of carrying out micro processing, for example using the technique of phot lithography, and driving a traveling contact, a motion of a traveling contact is accelerable. Consequently, the advantage which can offer the quick accumulation mold microswitch of a response is acquired.
[0025] Furthermore, since the accumulation mold microswitch by this invention can be made into the fine structure, it can mount the switch of many numbers in a small tooth space. Consequently, a complicated electronic switch can be integrated in the configuration of semiconductor device extent, and that application will be considered widely.
[0026]
[Embodiment of the Invention] One example of the accumulation mold microswitch proposed by claims 1, 2, 10, and 12 of this invention to drawing 1 thru/or drawing 4 is shown. 11 in drawing shows the substrate which consists of semi-conductors, such as silicon and gallium arsenide. The accumulation mold microswitch by this invention makes the open section of the stationary contacts 13A, 13B, 14A, and 14B prepared on the insulating layer 12 of a substrate 11 the structure which opens and closes each electrically by traveling contacts 16A and 16B. Traveling contacts 16A and 16B are united with the movable plate 18, and it insulates from the conductive movable plate 18 electrically, and they are prepared by the insulating layer 26 (refer to drawing 2).
[0027] A stanchion 15 is formed in the center section of the top face of a substrate 11. A movable plate 18 is supported with this stanchion 15 by the condition in which a seesaw movement is possible. The station keeping means 19 for maintaining the relative location of the movable plate 18 to a substrate 11 is projected and formed in the both sides of a movable plate 18 at one with a conductive ingredient, for example like polish recon which constitutes a movable plate 18. The case where the hinge in which elastic deformation is possible constitutes the

station keeping means 19 from this example is shown. The tip of the station keeping means 19 is connected to the insulating layer 12 of a substrate 11 electrically mechanically at the polar zone 21 formed by the metal deposit etc. The station keeping means 19 is formed for a long time as much as possible, and shows the case where elastic deformation made it move in a zigzag direction in the example shown in drawing 1 , and forms so that easily. A movable plate 18 is maintained by the condition that it is supported by the upper part of a stanchion 15 and a location gap does not arise with the station keeping means 19. The station keeping means 19 does not need to give the elastic biased force to a movable plate 18, and should just prevent a location gap of a movable plate 18. For this reason, the station keeping means 19 does not need reinforcement that what is necessary is just to form in the shape of a thin line.
[0028] It counters with the inferior surface of tongue of a movable plate 18, and the lower electrodes 22A and 22B are formed on the insulating layer 12 of a substrate 11. These lower electrodes 22A and 22B are arranged bordering on a stanchion 15 at the position of symmetry, and are made into the structure where a voltage signal can be alternatively impressed from terminal areas 23A and 23B. If an electrical potential difference (forward and negative unlike-pole electrical potential difference) is impressed to a movable plate 18 and lower electrode 22A, with static electricity, a suction force will occur and traveling contact 16A will contact the traveling contact 16A side of a movable plate 18 at stationary contacts 13A and 13B. Therefore, between terminal 13A-1 and 13B-1 will be in switch-on. If an electrical potential difference is impressed to a movable plate 18 and lower electrode 22B on the contrary, shortly, a suction force will occur in the traveling contact 16B side of a movable plate 18, and traveling contact 16B will contact stationary contacts 14A and 14B. Therefore, between terminal 14A-1 and 14B-1 will be in switch-on in this case. The electrical equivalent circuit of the accumulation mold microswitch shown in drawing 3 at drawing 1 and drawing 2 is shown.
[0029] In addition, the case where the conductor which constitutes the signal-transmission track by which impedance matching was carried out in the stationary contact proposed by claim 15 from this example constitutes is shown. That is, stationary contacts 13A and 13B, and 14A and 14B show the case where the common potential layer 24 formed in the background of a substrate 11 constitutes a microstrip line, respectively. Therefore, stationary contacts 13A and 13B, and 14A and 14B can be used as a RF transmission line, and can be used for intermittence control of a RF signal. Moreover, as shown in drawing 1 and drawing 4 , much through tube 18A is formed in a movable plate 18. This through tube 18A is a through tube used by the manufacture approach explained by drawing 5 . The manufacture approach of the accumulation mold microswitch by this invention is explained using drawing 5 .
[0030] For example, an insulating layer 12 like Si O2 is formed in the top face of the substrate 11 of silicon or a semi-conductor like gallium arsenide (drawing 5 A). Furthermore, the common potential layer 24 which constitutes a microstrip line is formed in the background of a substrate 11. Stationary contacts 13A and 13B, 14A, 14B and the lower electrodes 22A and 22B, terminal 13A-1, 13B-1 and 14A-1, 14B-1, and 23A and 23B are formed in the top face of an insulating layer 12 for example, by the sputtering method etc. Furthermore, pedestal 21A which becomes a stanchion 15 and the polar zone 21 by approaches, such as plating, is formed (refer to drawing 5 B).
[0031] Next, the resin layers 25, such as polyimide, are applied and formed in the forming face of stationary contacts 13A and 13B, 14A and 14B and the lower electrodes 22A and 22B and a stanchion 15, and pedestal 21A. The resin layer 25 is applied to a stanchion and extent slightly thicker than the height of pedestal 21A, by etching, exposes the front face of stanchion 15A and pedestal 21A, and forms a flat side. Furthermore, the conductor used as traveling contacts 16A and 16B is formed in this flat side (refer to drawing 5 C).
[0032] Next, an insulating layer 26 is formed all over the resin layer 25, further, on it, the laminating of for example, the polish recon and Aluminum aluminum which should serve as a movable plate 18 is carried out by the spatter by turns, and a conductive layer is formed all over an insulating layer 26. A photoresist is applied to the top face of a conductive layer, a photoresist pattern is formed in the part which should serve as a configuration of a movable plate 18, and the station keeping means 19 and the polar zone 21, wet etching or ion milling

removes the conductive layer of a part from which the photoresist was removed, and a movable plate 18, the station keeping means 19, and the polar zone 21 are formed. In addition, in this etching process, through tube 18A (refer to drawing 4) is also formed in the part which should serve as a movable plate 18. Where a movable plate 18, the station keeping means 19, and the polar zone 21 are formed, a movable plate 18, the station keeping means 19, and the insulating layer 26 exposed to parts other than polar-zone 21 are removed (refer to drawing 5 D).
[0033] Next, except for the central part of a movable plate 18, as shown in drawing 5 E, a mask M1 is put on other parts, through through tube 18A formed in the movable plate 18, by wet etching or dry etching, an insulating layer 26 is etched and an opening G1 is formed between the top face of a stanchion 15, and a movable plate 18 (drawing 5 E). Next, a mask M1 is removed, the parts of a movable plate 18, the station keeping means 19, and the polar zone 21 are used as a mask, etching removal only of the resin layer 25 is carried out, and the cavity G2 shown in drawing 5 F is formed between a movable plate 18 and a substrate 11. By forming this cavity G2, the accumulation mold microswitch shown in drawing 1 thru/or drawing 4 is obtained. Thus, since an accumulation mold microswitch is made by the manufacturing technology of a semiconductor integrated circuit, it can make many accumulation mold microswitches collectively on an as a whole very small common substrate. As it incidentally cuts in the shape of a chip and the magnitude of a substrate 11 is shown in drawing 4 , width of face W is 0.5mm, and die-length L is 1.0mm, Thickness T is set to about 0.3mm. In addition, generally the resin layer 25 used in order to form a cavity G2 is called the sacrifice layer.
[0034] Drawing 6 and drawing 7 show the deformation example of the accumulation mold microswitch proposed by claims 1 and 2 of this invention. The case where the accumulation mold microswitch of the circuit structure shown in drawing 8 is constituted from this example is shown. The same sign is attached and shown in drawing 1 thru/or drawing 5 , and a corresponding part. That is, by the continuous signal line's constituting stationary contacts 13A and 14A from this example, and leading a configuration in a movable plate 18, leading the polar zone 21 in a movable plate 18 with a conductor, and connecting with the common potential point CM (referring to drawing 8) If stationary-contact 13A will be connected to the common potential point CM, transmission of a signal will be intercepted, if a movable plate 18 is contacted to stationary-contact 13A, and a movable plate 18 is contacted to stationary-contact 14A, the switch by which stationary-contact 14A is connected to the common potential point CM, and transmission of a signal is intercepted will be performed.
[0035] For this reason, a movable plate 18 is formed by metaled multilayers. first, the condition of having formed the resin layer 25 shown in drawing 5 C -- the whole surface of the resin layer 25 -- sputtering -- the order of Ti, Pd, and Au -- metaled multilayers -- forming -- further -- a it top -- for example, nickel alloy plating -- about 20 micrometers extent -- it forms thickly. Ion milling removes the garbage of the metal layer which uses this thick nickel alloy deposit as a mask, and consists of Ti, Pd, and Au layer, and a movable plate 18, a hinge 19, and the polar zone 21 are formed. In addition, the traveling contact of a movable plate may be the capacitor structure of the metal and insulator layer which lets an alternating current pass.
[0036] Since Ti layer is easily removable by the chemical etching of HF system, etching removal of this Ti layer is carried out, and a stanchion 15 and a movable plate 18 are separated. Moreover, since the amount of [of a movable plate 18] contact surface is also desirable, Pd also removes Ti layer of this part. In addition, if it considers as the detached core of a stanchion 15 and a movable plate 18, you may use on both sides of resin like a photoresist. Drawing 9 thru/or drawing 11 show the example of further others of the accumulation mold microswitch proposed by claims 1 and 2 of this invention. The structure of the accumulation mold microswitch suitable for constituting the change-over circuit shown in drawing 11 from this example is shown. That is, the source SU of a signal is connected to terminal 13B-1, and the case of the change-over circuit which performs the switch which takes out the signal of the source SU of a signal from terminal 14A-1, or is intercepted is shown. By connecting terminal 14B-1 to the common potential point CM, it is the circuit which considered leaking even when it connects terminal 14A-1 to the common potential point CM by traveling contact 16B where a signal is intercepted, and the signals of the source SU of a signal are few to terminal 14A-1 as

the configuration to prevent.
[0037] For this reason, in the circuit shown in drawing 11 , it can switch to the condition of intercepting with the condition of outputting the signal of the source SU of a signal to terminal 14A-1, by connecting between stationary contacts 13A and 14A with wiring 17 (referring to drawing 9), and switching between stationary contacts 13A and 13B to the condition of ON and OFF of between 14A and 14B in alternation by the seesaw movement of a movable plate 18. The example shown in this drawing 9 thru/or drawing 11 is multi-functionalized by forming wiring 17, and can make an accumulation mold microswitch by the same manufacture approach with drawing 5 having explained. In addition, you may be the switch which prepared the component of resistance or a capacitor on the same substrate like this, and integrated these.
[0038] Drawing 12 and drawing 13 show the example of the accumulation mold microswitch which constituted the stationary contact proposed by claim 15 thru/or 17 on the predetermined signal-transmission track by which impedance matching was carried out. That is, the case where the KOPURENA mold signal-line way which is one form of a slip line constitutes stationary contacts 13A and 13B, and 14A and 14B from this example is shown. That is, a KOPURENA mold signal-line way can be constituted by arranging the conductors 27A and 27B which have common potential in stationary contacts 13A and 13B and each both sides of 14A and 14B. In this case, the common potential layer 24 put on the rear face of a substrate 11 does not necessarily need to exist.
[0039] In addition, this example shows the case where formed in the top face of the insulating layer 12 of a substrate 11 insulating-layer 12' (drawing 13) which has thickness further, formed stationary contacts 13A and 13B, 14A and 14B, and the common potential conductors 27A and 27B in the top face of this insulating-layer 12', and a KOPURENA mold microstrip line is formed. Moreover, a stanchion 15 is formed in the upper part of this insulating-layer 12', and the lower electrodes 22A and 22B form crevice 12'A in this insulating-layer 12', and it shows the case where covering formation is carried out to the insulating layer 12 exposed by this crevice 12'A.
[0040] Drawing 14 thru/or drawing 16 show the example of the accumulation mold microswitch possessing the up electrodes 28A and 28B proposed by claim 3 of this invention, and the accumulation mold microswitch which made the traveling contacts 16A and 16B proposed by claim 13 the configuration in which elastic deformation is possible. Repulsive force or a suction force can be generated among the lower electrodes 22A and 22B, and the seesaw movement of the movable plate 18 can be made to carry out in any direction in this example by forming the up electrodes 28A and 28B in the top face of a movable plate 18, and supplying a voltage signal to each of these up electrodes 28A and 28B separately through the polar zone 21 and a hinge 19. In addition, although through tube 18A formed in a movable plate 18 is omitted in drawing 14 , much through tube 18A is formed like drawing 1 in fact.
[0041] Furthermore, the structure by which it is characterized [of this example] is the point made into the structure of making traveling contacts 16A and 16B projecting from the edge of a movable plate 18, forming, and contacting this part made projecting to stationary contacts 13A and 13B, and 14A and 14B, as shown in drawing 15 and drawing 16 . Flexibility is given to traveling contacts 16A and 16B by having made traveling contacts 16A and 16B project from the edge of a movable plate 18. Therefore, in case traveling contacts 16A and 16B contact stationary contacts 13A and 13B, and 14A and 14B by this flexibility Since traveling contacts 16A and 16B carry out elastic deformation and it contacts, traveling contacts 16A and 16B will perform sliding actuation somewhat on stationary contacts 13A and 13B, and 14A and 14B. By this sliding actuation It considers as the structure which expected that the so-called self-cleaning operation would be acquired. The case where drawing 15 considers as the structure made to project in the shape of a straight line from the top face of a movable plate 18 is shown, and drawing 16 shows the case where it considers as the structure made to project from the inferior-surface-of-tongue side of a movable plate 18 involving an end face from the top face of a movable plate 18.
[0042] The manufacture approach of the accumulation mold microswitch of the structure shown in drawing 15 using drawing 17 is explained. the semi-conductor substrate 11 top possessing the insulating layer 12 which consists of Si N -- for example, Si O2 from -- while forming insulating-

layer 12' which changes and forming stationary contacts 13A and 13B, and 14A and 14B on this insulating-layer 12', crevice 12'A is formed in insulating-layer 12', and an insulating layer 12 is exposed on the base of this crevice 12'A. The lower electrodes 22A and 22B and a stanchion 15 are formed in the exposure of an insulating layer 12 (drawing 17 A).
[0043] a resin layer [which applies the resin layers 25, such as polyimide, to this front face forms a flat front face, carries out etchback of the resin layer 25 to extent which the top face of a stanchion 15 exposes, and turns into the 1st sacrifice layer] 25, and insulating-layer 12' top -- for example, Pori Si where etching is easy from -- the insulating layer 26 which changes is formed. In the front face of an insulating layer 26, laminating formation of the insulating multilayers is carried out by the spatter at the sequence of PolySi-Si N-Si O2-Si N, a photoresist pattern is put on these insulating multilayers as a mask, and pedestal 21A (refer to drawing 4) of a movable plate 18, the station keeping means 19, and the polar zone 21 is formed by dry etching. By the balance of stress, this laminated structure has small curvature, and the movable plate 18 with strong reinforcement is obtained. In addition, as this dry etching showed to the movable plate 18 at drawing 4 , much through tube 18A shall be formed (drawing 17 B).
[0044] next, the insulating layer 26 on the center section on the background of a movable plate 18 and the background of the station keeping means 19 (not displayed on drawing 17) was formed in the movable plate 18 -- it through-tube 18A (refer to drawing 4) leads, and it etches and an opening G1 is formed between a movable plate 18 and a stanchion 15. A stanchion 15 and a movable plate 18 are separated by formation of this opening G1. The 2nd sacrifice layer 29 which consists of resin layers, such as a photoresist, is applied to this front face, a flat front face is formed, and etchback of the resin layer 29 is carried out until the top face of a movable plate 18 is further exposed (drawing 17 C).
[0045] The laminating of the metal is carried out to the sequence of Pd-Mo-Au on the front face of a movable plate 18, and the traveling contacts 16A and 16B and the up electrodes 28A and 28B for a switch are formed in a mask for a photoresist pattern by nickel plating. This nickel deposit is used as a mask and an unnecessary metal layer is removed by ion milling (drawing 17 D). Next, by removing the resin layers 25 and 29 by etching, a cavity G2 is obtained and the accumulation mold microswitch shown in drawing 15 is obtained (drawing 17 E).
[0046] The deformation example of the example shown in drawing 18 and drawing 19 at drawing 14 thru/or drawing 16 is shown. In the example shown in drawing 18 , a stanchion 15, stationary contacts 13A and 13B and 14A and 14B, and the lower electrodes 22A and 22B are formed in the flat side of a substrate 11 through an insulating layer 12, and the accumulation mold microswitch of the structure which equipped the movable plate 18 with the up electrodes 28A and 28B and traveling contacts 16A and 16B is shown. The drive of a movable plate 18 impresses an electrical potential difference to the lower electrodes 22A and 22B and the up electrodes 28A and 28B, and is performed by electrostatic drive. According to the structure of this example, even if substrates 11 are any of a conductor, a semi-conductor, and an insulator, it has the description which can constitute an accumulation mold microswitch. A stanchion 15 and a movable plate 18 are formed with an insulator.
[0047] Drawing 19 shows the example which formed the stanchion 15 by substrate 11 the very thing. That is, it is Si as a substrate 11 in this case. Or Ga Aa A semi-conductor substrate [like] is used, etching processing of this substrate itself is carried out, and a stanchion 15 is formed. After forming a stanchion 15, an insulating layer 12 is formed, and stationary contacts 13A and 13B, 14A and 14B, and the lower electrodes 22A and 22B are formed on an insulating layer 12. The structure by the side of a movable plate 18 is the same as that of drawing 18 .
[0048] Drawing 20 and drawing 21 show the example of the accumulation mold microswitch proposed by claim 4 of this invention. The accumulation mold microswitch proposed by claim 4 has the description in the structure of a driving means of driving a movable plate 18. As a configuration by which it is characterized [the], counter the both sides by the side of one rotation free end of a substrate 11, and the rotation free end of another side with each, and two or more lower electrode 22A-1, 22A-2 and 22B-1, and 22B-2 are prepared for them. By impressing a unlike-pole electrical potential difference to each of lower electrode 22A-1 of these plurality, 22A-2, and 22B-1 and 22B-2, a suction force is given at a movable plate 18, and it is in

the point made into the structure which carries out a seesaw movement.
[0049] The actuation which gives a suction force to a movable plate 18 using drawing 21 is explained. Drawing 21 shows the cross section on the F-F line shown in drawing 20 . Lower electrode 22B-1 and 22B-2 are countered, and a movable plate 18 is arranged. If a movable plate 18 shall have conductivity, electrostatic capacity C1 and C2 will be formed between lower electrode 22B-1 and a movable plate 18 and between lower electrode 22B-2 and a movable plate 18. lower electrode 22B- 1 and 22 -- the electrical potential difference VDC which the charge was accumulated in such electrostatic capacity C1 and C2, and impressed the potential of a movable plate 18 between lower electrode 22B-1 and 22B-2 when forward and the negative electrical potential difference VDC were impressed among B-2 -- it is mostly stabilized in central potential.
[0050] When a charge is charged by electrostatic capacity C1 and C2, the suction force by static electricity occurs between lower electrode 22B-1 and a movable plate 18 and between lower electrode 22B-2 and a movable plate 18. Therefore, the seesaw movement of the movable plate 18 can be carried out by impressing an electrical potential difference VDC to each lower electrode pair of lower electrode 22A-1, 22A-2, and 22B-1 and 22B-2 by turns. In addition, although **** explained as an electrical conducting material as the quality of the material of a movable plate 18, the seesaw movement especially of the limitation can be carried out also by the movable plate unnecessary and formed with the insulating material. It is detailed (refer to the 101-104 pages of the measurement and 38th volume No. 2 February, 1999 issues of control).
[0051] Moreover, although the example shown in drawing 20 showed the example which prepared lower electrode 22A-1 of a pair, 22A-2, and 22B-1 and 22B-2 in rotation one end of one side of a movable plate 18, and another side, respectively, not only a pair but three sheets thru/or the lower electrode of the number of sheets beyond it can be formed, a unlike-pole electrical potential difference can be alternatively impressed to the lower electrode of these plurality, and the seesaw movement of the movable plate 18 can be carried out. According to the accumulation mold microswitch shown in drawing 20 , it is not necessary to supply an electrical potential difference to a movable plate 18 like the example shown in drawing 1 or drawing 6 , and to give electric wiring to the part of the station keeping means 19. Therefore, the advantage which can simplify manufacture from the accumulation mold microswitch shown in drawing 1 or drawing 6 is acquired. Moreover, since electric wiring is not formed in the hinge which constitutes the station keeping means 19, the advantage whose endurance can also improve is acquired.
[0052] Drawing 22 thru/or drawing 29 show the example of the accumulation mold microswitch proposed by claim 11. The accumulation mold microswitch proposed by claim 11 is characterized by the structure constituted by the bearing 30 which is made to penetrate a movable plate 18, support shaft 18B formed in one, and this support shaft 18B as a station keeping means 19, and is supported. Bearing 30 is constituted by the base 31 which protruded on the plate surface of a substrate 11, and the arch 32 (drawing 23) formed in the upper part of this base 31, and is made into the structure of making the hollow hole surrounded on the arch 32 and the base 31 penetrating support shaft 18B, and maintaining the location of a movable plate 18. Although support shaft 18B, a base 31, and each manufacture approach of an arch 32 will be explained later, the case where the base 31 and the arch 32 were formed by electric conduction material, and also form a movable plate 18 and support shaft 18B by electric conduction material further here is shown.
[0053] Therefore, an electrical potential difference can be impressed to a movable plate 18 through a base 31. The seesaw movement of the movable plate 18 can be carried out by impressing by turns a different polar electrical potential difference from the electrical potential difference impressed to the movable plate 18 to the lower electrodes 22A and 22B. Although the example of drawing 22 and drawing 23 explained the case where it considered as the structure of forming a movable plate 18 and support shaft 18B with an electrical conducting material, impressing electric field between a movable plate 18 and the lower electrodes 22A or 22B, and generating a suction force A-2, and 22B-1 and 22B-2 are prepared. one rotation free end side of the movable plate 18 which carries out a seesaw movement as shown in drawing 24 , and the

rotation free end side of another side -- respectively -- alike -- receiving -- lower electrode 22A- of a pair -- 1 and 22 -- An electrical potential difference can be impressed to each pair of these lower electrode 22A-1, 22A-2, and 22B-1 and 22B-2, and the seesaw movement of the movable plate 18 can be carried out.

[0054] Since it is not necessary to impress an electrical potential difference to a movable-plate 18 side when taking the drive structure shown in drawing 24 , especially the quality of the material of a movable plate 18 does not need to be a metal, and the advantage which can be constituted from all ingredients, such as an insulator or a semi-conductor, is acquired. Since it is supported so that it may be supported so that a movable plate 18 can mainly carry out a seesaw movement with a stanchion 15 according to the operation structure shown in this drawing 22 thru/or drawing 24 , and a location gap may not occur [support shaft 18B] by bearing 30 further, a movable plate 18 cannot receive the reaction force from the outside, therefore a seesaw movement can be carried out with few suction forces. Moreover, the contact condition stabilized since the reaction force which is going to pull apart the contact condition was not given in the state of contact to traveling contacts 16A and 16B, stationary contacts 13A and 13B, and 14A and 14B is maintainable.

[0055] The manufacture approach (claim 24) of the accumulation mold microswitch shown in drawing 22 thru/or drawing 24 using drawing 25 thru/or drawing 29 is explained. The manufacture approach of support shaft 18B and bearing 30 will be explained in detail especially here. for example, the substrate 11 which consists of silicon -- preparing -- the inferior-surface-of-tongue side of this substrate 11 -- a ground -- while forming the common potential layer 24 used as a conductor, an insulating layer 12 is formed in a top-face side (drawing 25 A).

[0056] While forming a conductive layer 33 in the location which should carry out covering formation of the metal layer by vacuum evaporationo etc., and should form a base 31 (refer to drawing 23 and drawing 24) in the top face of an insulating layer 12 through processes, such as a photo mask and etching, stationary contacts 13A and 13B, and 14A and 14B are formed (drawing 25 B). [the lower electrodes 22A and 22B, and] In addition, the conductive layer for forming a stanchion 15 behind a conductive layer 33 in drawing 25 B is also formed. A mask is formed in the condition of having exposed only the conductive layer for forming a conductive layer 33 and a stanchion 15, by a photoresist layer etc., and a deposit is formed on a conductive layer 33 and the conductive layer which should form a stanchion 15. This deposit serves as the base 31 and stanchion 15 which constitute bearing 30 (drawing 25 C).

[0057] The 1st sacrifice layer 34 which changes from a resist layer to the same height as a base 31 and a stanchion 15 is formed, a metal layer is formed by vacuum evaporationo etc. all over this 1st sacrifice layer 34, it leaves this metal layer to a predetermined pattern by etching, and traveling contacts 16A and 16B are formed (drawing 25 D). After forming traveling contacts 16A and 16B, the 2nd sacrifice layer 35 equal to the thickness of traveling contacts 16A and 16B is formed, and the metal layer 36 is formed in the whole top face of this 2nd sacrifice layer 35. Hole 36A is formed in the location (refer to drawing 25 D and drawing 28) which counters this metal layer 36 with a base 31.

[0058] The metal layer 36 is used as a mask and hole 36B is formed also in the 2nd sacrifice layer 35 (drawing 26 A). Therefore, it will be in the condition that the base 31 was exposed to the base of Holes 36A and 36B (drawing 26 A). Next, other parts except the part which should give a mask to the top face of the metal layer 36, for example, should form the movable plate 18 of the metal layer 36 and support shaft 18A by ion milling are removed, and a movable plate 18 and the configuration of support shaft 18B are formed by the metal layer 36 (drawing 26 A, drawing 29).

[0059] A photoresist layer 37 is again put on the whole surface in the condition of drawing 26 A. The thickness of this photoresist layer 37 is formed in the thickness of extent almost equal to the thickness of a movable plate 18 (drawing 26 B). The pattern (configurations of a movable plate 18 and support shaft 18B) of the same configuration as the metal layer 36 is exposed to a photoresist layer 37, and the photoresist layer 37 located in the upper part of the metal layer 36 is removed. Therefore, it will be in the condition that the metal layer 36 was exposed to the interior surrounded by the photoresist layer 37 (drawing 26 C).

[0060] Where the metal layer 36 is exposed, it plates on the top face of the metal layer 36, and the deposit 38 almost equal to the thickness of a movable plate 18 is formed. Of this deposit 38 and the metal layer 36, a movable plate 18 and support shaft 18B are formed, further, a base 31 is contacted and column 38A of an arch is formed in the interior of Holes 36A and 36B (drawing 26 D). The 3rd sacrifice layer 39 which consists of a photoresist layer again is put on the top face of a photoresist layer 37 and a deposit 38, this 3rd sacrifice layer 39 is countered with hole 36A shown in drawing 28 and drawing 29 , hole 39A is formed, and the metal layer 41 is formed in the top face of the 3rd sacrifice layer 39 by approaches, such as vacuum evaporationo, (drawing 27 A).
[0061] The 4th sacrifice layer 42 which consists of a photoresist layer further is put on the top face of the metal layer 41, and long hole 42A which connected the part of hole 39A with this 4th sacrifice layer 42 is formed (drawing 27 B). By forming long hole 42A, the metal layer 41 is exposed on the base of long hole 42A. It plates with this condition in the metal layer 41 in long hole 42A, and a deposit 43 is formed (drawing 27 B).
[0062] Where a deposit 43 is formed, while removing the 4th sacrifice layer 42, ion milling removes the metal layer 41. In this case, a deposit 43 acts as a mask and it is removed except the part in which the metal layer 41 formed the deposit 43. Furthermore, the movable plate 18 shown in drawing 27 C, support shaft 18A, and an arch 32 are formed by removing the 3rd sacrifice layer 39, a photoresist layer 37 and the 2nd sacrifice layer 35, and the 1st sacrifice layer 34 by approaches, such as etching. That is, a movable plate 18 and support shaft 18A are constituted by a deposit 38 and the metal layer 36, and an arch 32 is constituted by column 38A formed by the deposit 38, the metal layer 41, and the deposit 42. Furthermore, bearing 30 is constituted by an arch 32 and the base 31, and it is formed in the condition that support shaft 18B penetrated a part for the centrum formed at an arch 32.
[0063] By the manufacture approach explained above, since it was mainly supported with the stanchion 15 and support shaft 18B has penetrated to bearing 30 further, the location of a movable plate 18 does not shift and it does not separate from the self-weight of a movable plate 18 from a substrate 11, so that clearly. Furthermore, since it formed mainly by the deposit, by [for which a base 31, support shaft 18B and a movable plate 18 have conductivity] impressing one polar electrical potential difference to a base 31, and impressing the polar electrical potential difference of another side to the lower electrodes 22A and 22B by turns, a suction force can occur with static electricity between a movable plate and each lower electrodes 22A or 22B, and the seesaw movement of the movable plate 18 can be carried out.
[0064] Drawing 30 thru/or drawing 32 show the example of the accumulation mold microswitch proposed by claim 5 of this invention. The accumulation mold microswitch proposed by claim 5 proposes the accumulation mold microswitch made into the structure of performing the drive of a movable plate 18 by the magnetism generated with a flat-surface coil. For this reason, by forming the flat-surface coils 45A and 45B in the top face of a movable plate 18 bordering on the supporting point at the position of symmetry, and passing an exciting current alternatively in these flat-surface coils 45A and 45B, as shown in drawing 31 Repulsive force and a suction force are generated by the field given with the permanent magnets 46A and 46B shown in drawing 31 , and it considers as the structure of contacting traveling contacts 16A and 16B to stationary contacts 13A and 13B, and 14A and 14B.
[0065] Although the example shown in drawing 31 showed the case where it considered as the structure which supplies an exciting current separately to the flat-surface coils 45A and 45B, if the flat-surface coils 45A and 45B are wound and formed in the relation which rolls mutually as shown in drawing 32 , series connection of these is carried out and an exciting current is supplied from terminal 21A-1 of a pair, and 21A-2, the flat-surface coils 45A and 45B of a pair will generate the field of the reverse sense mutually. Therefore, since one side and another side always generate a suction force and repulsive force to permanent magnets 46A and 46B, they can generate twice as many torque as this.
[0066] Thus, if the sense of the current which will be supplied from terminal 21A-1 and 21A-2 if constituted is reversed, the rotation direction of a movable plate 18 is controllable in the direction of the arbitration of the normal rotation direction and the inversion direction. Therefore,

that what is necessary is just to form in the both sides of a movable plate 18 at a time-one wiring which supplies a current to the flat-surface coils 45A and 45B therefore, when taking the structure shown in this drawing 32 , since what is necessary is just to also form one station keeping means 19 at a time, structure can be simplified.
[0067] Drawing 33 and drawing 34 show the example of the accumulation mold microswitch proposed by claim 6 of this invention. The accumulation mold microswitch shown in this drawing 33 and drawing 34 shows the deformation example of the accumulation mold microswitch of the flat-surface coil drive mold shown in drawing 30 thru/or drawing 32 . In order that the description on the structure of this example may raise the generating reinforcement of a field, an exiting coil is wound and manufactured independently to tubed. Load with this exiting coil the hole formed in the substrate, and it fixes by resin material. It is in the point which formed the stationary contact in the front face of the substrate which carried out data smoothing of the front face of a substrate, and was graduated where an exiting coil is laid underground, formed the movable plate 18 in the condition in which a seesaw movement is possible further, and constituted the accumulation mold microswitch of a magnetic drive mold.
[0068] Although the example shown in drawing 33 and drawing 34 shows the case where a movable plate 18 is formed with the magnetic substance, the configuration which the magnetic substance, especially a ferromagnetic are stuck [configuration] on a movable plate 18 like the example shown in drawing 38 and drawing 39 , and generates magnetic adsorption power can also be taken. The manufacture approach of the accumulation mold microswitch shown in drawing 33 and drawing 34 using drawing 35 thru/or drawing 37 is explained. Auxiliary substrate 11A shown in drawing 35 A is prepared. This auxiliary substrate 11A may be an electric insulating plate, or may be an electric conduction plate like copper.
[0069] Covering formation of the middle plate 11B is carried out in one field of auxiliary substrate 11A, and these auxiliary substrate 11A and middle plate 11B constitute a substrate 11. Middle plate 11B may also be an electric insulating plate, or you may be an electric conduction plate. Although, as for substrate 11A, a limit is not given to especially thickness that moderate reinforcement should just be obtained, even when the thickness of middle plate 11B is slighter than the coil length (the die length of magnetic-core 62A) of the exiting coil 62 explained later, it is selected in a large dimension. For example, when selecting the die length of magnetic-core 62A to 0.6mm, it selects to about 0.7-0.8mm.
[0070] To middle plate 11B, predetermined spacing (decided with the die length of a movable plate 18) is held, and a hole 63 is formed. Although the process which manufactures one accumulation mold microswitch by a diagram is shown, group formation of many holes 63 is carried out in fact, and many accumulation mold microswitches are manufactured at once. A copper layer may be formed in the thickness of about 0.65-0.70mm by approaches, such as plating, like one field of auxiliary substrate which put with adhesives middle plate in condition that form hole 63 for example, in middle plate 11B by press or etching beforehand, and hole 63 was formed 11B on auxiliary substrate 11A, or used copper for auxiliary substrate 11A, and was formed with this copper 11A.
[0071] When middle plate 11B is formed by plating, a hole 63 is formed in this middle plate 11B with the technique of phot lithography. The diameter of a hole 63 is greatly formed in extent by which a crevice is somewhat formed between the periphery of an exiting coil 62, and the wall of a hole 63. Where an exiting coil 62 is inserted in a hole 63, crevice 63A (refer to drawing 37) formed between the interior of a hole 63, especially the peripheral face of an exiting coil 62 and the internal surface of a hole 63 is filled up with resin material, and the resin layer 64 which applies the still more nearly same resin material also on the front face of middle plate 11B, and has desired thickness is formed (drawing 35 B).
[0072] After the resin layer 64 has solidified, cutting of the front face of the resin layer 64 is further carried out to a part for the lobe of electrode 62C, and mirror plane finishing of the front face of the resin layer 64 is carried out (drawing 35 C). Electrode 62C will be in the condition of having exposed in the condition flat-tapped with the resin layer 64 in the field of the resin layer 64 by which mirror plane finishing was carried out. This electrode 62C is made to contact, wiring 65 and an electrode 66 (drawing 33) are formed, and the current supply source way of an

exiting coil 62 is formed. A conductive layer is formed in the part which should form stationary contacts 13A and 13B, 14A and 14B and terminal area 13A-1, 13B-1, 14A-1, 14B-1, a stanchion 15, and a base 31 in this and coincidence with the technique of phot lithography.
[0073] Next, a mask like a photoresist is formed in wiring 15, an electrode 66, stationary contacts 13A, 13B, 14A, and 14B and terminal area 13A-1, 13B-1, 14A-1, and 14B-1. A hole is formed in the part which should form a stanchion 15 and a base 31 in this mask, a conductive layer is exposed into the part of this hole, and covering formation of a stanchion 15 and the base 31 is carried out with means, such as plating, at this exposed conductive layer (drawing 35 D). The process after forming a stanchion 15 and a base 31 completes the accumulation mold microswitch of the magnetic drive mold which forms support shaft 18A of a movable plate 18 and a movable plate 18 at the same process, forms traveling contacts 16A and 16B in the rotation free end section of a movable plate 18, forms an arch 32 in the upper part of a base 31 further, and is shown to drawing 38 and drawing 39 that drawing 25 thru/or drawing 29 explained.
[0074] The difference from the production process explained by drawing 25 thru/or drawing 29 by **** is the point of selecting the quality of the material of a movable plate 18 to a magnetic material. What is necessary is just to use iron-nickel etc. as a magnetic material, for example. According to the structure of the accumulation mold microswitch of the magnetic drive mold shown in drawing 33 and drawing 34 , a field occurs, one rotation free end of a movable plate 18 is attracted by the exiting coil 62, and traveling contacts 16A or 16B make it flow through either stationary-contact 13A.13B, or 14A and 14B by this field by impressing an exciting current to either of the exiting coils 62.
[0075] Since the exiting coil 62 was formed with the coil and magnetic-core 62A has been arranged further, a strong field occurs as compared with the case of the flat-surface coil shown in drawing 30 thru/or drawing 32 . Consequently, the contact pressure to which traveling contacts 16A or 16B contact stationary-contact 13A.13B, and 14A and 14B can be obtained strongly, and the advantage which can maintain a stable contact condition is acquired. Drawing 38 and drawing 39 form a movable plate 18 by the non-magnetic material, and show the example which stuck the piece 67 of magnetic adsorption which changes from magnetic material to the top face of this movable plate 18. Thus, when a movable plate 18 and the piece 67 of magnetic adsorption are divided into another object, as a piece 67 of magnetic adsorption, it can be used being the quality of the material which cannot be formed as a movable plate 18 by sputtering etc., an ingredient especially with high permeability can be selected, and the advantage which can obtain the powerful accumulation mold microswitch of magnetic adsorption power by this is acquired.
[0076] Moreover, the contact pressure between contacts can be raised further further by making the piece 67 of magnetic adsorption magnetize N-south pole in the thickness direction beforehand. That is, adsorption power can be generated in one rotation one end of a movable plate 18, and rotation one end of another side can be made to generate repulsive force by arranging both the side fronts of the piece 67 of magnetic adsorption with N pole, arranging them, exciting two exiting coils 62 in differential, and generating a unlike pole. Therefore, as compared with the case of drawing 33 and drawing 34 , twice [about] as many contact pressure as this can be obtained according to adsorption power and repulsive force.
[0077] Drawing 40 shows the example of the accumulation mold microswitch proposed by claim 18 of this invention. In this example, while supporting a movable plate 18 with cantilever structure, the case where it considers as the structure which laid underground the exiting coil 62 of the structure which countered with the rotation free end section of a movable plate 18, and was shown in drawing 36 is shown. In this example, it forms by the magnetic material which has conductivity as a movable plate 18, and when the rotation free end of a movable plate 18 contacts a stationary contact 13, the case where it considers as the structure of making between polar-zone 13A-1 and 14A-1 attaching and detaching electrically is shown.
[0078] Since coil 62B which wound the exiting coil 62 around magnetic-core 62A and this magnetic-core 62A constituted also that manufacture is easy and in [since structure is simple according to this example] this case, magnetic adsorption power can be acquired strongly. Consequently, since the movable plate 18 of cantilever structure can be made to curve enough

even if it strengthens reinforcement, the fault of the Prior art explained by drawing 49 and drawing 50 is canceled. Drawing 41 shows the example of the accumulation mold microswitch proposed by claim 19 of this invention. This example shows the case where it considers as the structure where the stationary contact 13 was made to support by the piece 68 of stationary-contact support of cantilever structure. In this case, when it considers as the conductor which consists of nonmagnetic material and a movable plate 18 contacts a stationary contact 13, the piece 68 of stationary-contact support makes the piece 68 of stationary-contact support curve slightly by the thrust of a movable plate 18, slides between a movable plate 18 and stationary contacts 13 at the time of this curvature, and it is constituted so that self-cleaning actuation may be made to perform between contacts.

[0079] Drawing 42 and drawing 43 show the example of the accumulation mold microswitch proposed by claim 7 of this invention. The accumulation mold microswitch proposed by this claim 7 proposes the configuration which has arranged the exiting coil 62 to the top-face side of a movable plate 18. The same accumulation mold microswitch is formed with having been shown in the substrate 11 at drawing 22 and drawing 23 , and a substrate 72 is supported with a column 71 in the upper part of a substrate 11. A substrate 72 is constituted by auxiliary substrate 72A for obtaining reinforcement like the structure explained by drawing 33 and drawing 34 , and middle plate 72B for storing an exiting coil 62. A hole 73 is formed in middle plate 72B, an exiting coil 62 is inserted in this hole 73, the crevice formed between an exiting coil 62 and a hole 73 is filled up with resin material, and an exiting coil 62 is fixed to a substrate 72. The resin layer 74 is formed in the top face of an exiting coil 62, and the top face of middle plate 72B with this, mirror plane finishing of the front face of the resin layer 74 is carried out, and wiring 65 (refer to drawing 43) is formed in the front face of this resin layer 74 that carried out mirror plane finishing.

[0080] A conductor constitutes a column 71, wiring 65 is connected to the column 71 formed with this conductor, and it connects with the electrode 66 which established the excitation circuit of an exiting coil 62 in the front face of a substrate 11 through the column 71 electrically. The advantage which can manufacture easily since both can be coalesced and an accumulation mold microswitch can be made by making separately the substrate 11 which equipped the movable plate 18 by arranging an exiting coil 62 to the top-face side of a movable plate 18, and the substrate 72 equipped with an exiting coil 62, and projecting and preparing a column 71 for a substrate 72 beforehand as shown in drawing 42 and drawing 43 is acquired.

[0081] Drawing 44 shows the structure of the accumulation mold microswitch proposed by claim 20 of this invention. A multi-electrode switch is proposed in claim 20 of this invention. this example -- a movable plate 18 -- the shape of a polygon of a forward square -- carrying out -- the movable plate 18 of the shape of this polygon -- almost -- a core -- a stanchion 15 -- arranging -- four sides each -- the station keeping means 19 is mostly arranged into a central part. The up triangle-like electrodes 28A, 28B, 28C, and 28D are formed in four corners each of a movable plate 18. Traveling contacts 16A, 16B, 16C, and 16D are formed in the inferior-surface-of-tongue side of the four corners of a movable plate 18, and intermittence actuation of stationary contacts 13A and 13B, 13A', 13B', and 14A and 14B is carried out by these traveling contacts 16A-16D, respectively. In addition, it connects beforehand and is unified, and stationary-contact 14A' and 14B' can take out the signal inputted into stationary-contact 13A and 13A'14A to stationary-contact 14A', when any of traveling contacts 16A, 16C, and 16D they are contacts stationary contacts 13A and 13B, 13A', 13B', and 14A and 14B. Wiring formed in the field on the background of a movable plate 18 connects with a stanchion 15 electrically, and traveling contact 16D is connected to the common potential CM through a stanchion 15.

[0082] Moreover, in this example, the conductive layer (not especially shown) which has an area equivalent to the configuration of a movable plate 18 in the layer below the layer in which stationary contacts 13A and 13B, 13A', 13B', 14A and 14B, 14A', and 14B' were formed at least is formed, and let this conductive layer be a lower electrode. By inputting a voltage signal into this lower electrode through terminal areas 23A or 23B, a movable plate 18 can be leaned in the direction of arbitration with this lower electrode and the up electrodes 28A-28D.

[0083] According to the structure of the accumulation mold microswitch shown in drawing 44 ,

the circuit structure shown in drawing 45 is acquired. That is, it is the circuit which can take out the signal inputted for any of stationary-contact 13A, 13A', and 14A being to stationary-contact 14A'. When all the traveling contacts 16A, 16B, and 16C are opened wide, by contacting traveling contact 16D to stationary-contact 14A', stationary-contact 14A' is connected to the common potential CM through traveling contact 16D, and it considers as the configuration which prevents the leakage of a signal.

[0084] Drawing 46 shows the example of the accumulation mold microswitch proposed by claim 21 of this invention. Accumulation mold microswitches SW1 and SW2 of plurality [substrate / 11 / common to this example] -- The case where SW4 is formed is shown. Connection of each microswitch is carried out to desired circuitry with a circuit pattern (abbreviation among drawing). Drawing 47 shows the example of the accumulation mold microswitch proposed by claim 22 of this invention. This example shows actual mounting structure. The accumulation mold microswitch SW which consists of a substrate 11 and a movable plate 18 is stored in a hermetic container 50, terminals 51 and 52 are drawn from a hermetic container 50, through these terminals 51 and 52, a conversion signal is supplied and change-over control is carried out. the interior of a hermetic container 50 -- N2 [for example,] Or Ar etc. -- the inert gas for antioxidizing is enclosed and practical use is presented. Moreover, depending on the ingredient of stationary contacts 13A, 13B, 14A, and 14B and traveling contacts 16A and 16B, it is N2. O2 Using mixed gas is also considered.

[0085] Although the example explained above explained the case where the lower electrodes 22A and 22B and the up electrodes 28A and 28B were formed by the metal membrane, respectively, forming a high-concentration impurity range and using this by making this impurity range into a conductive layer as the lower electrodes 22A and 22B or up electrodes 28A and 28B is also considered. Moreover, it can also be understood easily that it is not what is limited to the configuration of the example which also mentioned above the configuration of the hinge which constitutes the station keeping means 19.

[0086] Drawing 48 shows the example of the accumulation mold microswitch proposed by claim 14 of this invention. This example shows traveling contacts 16A and 16B, stationary contacts 13A and 13B, and the deformation example of 14A and 14B. the case where it considers as the configuration which makes the stationary contacts 13A and 13B which formed the traveling contacts 16A and 16B of the pair which the rotation free end of a movable plate 18 boiled in this example, respectively, and was projected upward, and were formed in the beam 60 which separated and formed these traveling contacts 16A and 16B from the substrate 11, and 14A and 14B attach and detach is shown.

[0087] Although traveling contacts 16A and 16B are made into a cone configuration, upper limit is made into a flat side and made into the configuration which does not attach a blemish to the stationary contacts 13A and 13B which contact, and 14A and 14B. In the example of drawing 48 , a movable plate 18 is conductivity, traveling contacts 16A and 16B are directly formed in the top face of a movable plate 18, and the case where it considers as the configuration which makes between stationary-contact 13A and 13B and between each of 14A and 14B attach and detach electrically using the conductivity of a movable plate 18 is shown. In addition, what is necessary is to form a conductive layer through an insulating layer, when traveling contacts 16A and 16B need to be electrically insulated from a movable plate 18, and just to form a pair each of traveling contacts 16A and 16B which are in switch-on electrically on this conductive layer.

[0088] When a movable plate 18 forms with an insulating material, a direct conductive layer is formed in the top face of a movable plate 18, and a pair each of traveling contacts 16A and 16B which are in switch-on electrically are formed on this conductive layer. These stationary contacts 13A, 13B, 14A, and 14B are the processes before forming a beam 60, for example, can be formed by plating. A beam 60 is formed by the manufacture approach which forms the arch 32 explained by drawing 25 thru/or drawing 29 . Although a beam 60 is mainly formed with an electrical conducting material, an insulator 61 is inserted in a central part, and with this insulator 61, a beam 60 is made electric 2 ****s, and one side is used as stationary contacts 13A and 14A for this beam 60 carried out 2 ****s, and let another side be stationary contacts 13B and 14B.

[0089] These stationary contacts 13A and 13B, and 14A and 14B are electrically connected to terminal 13A-1, 13B-1 and 14A-1, and 14B-1, respectively. Thus, when it considers as the structure which forms traveling contacts 16A and 16B in the top-face side of a movable plate 18, the advantage which can simplify the manufacture approach as compared with the manufacture approach which forms traveling contacts 16A and 16B in the background of a movable plate 18 is acquired. In addition, the example shown in drawing 48 is what illustrates the example which forms traveling contacts 16A and 16B in the top-face side of a movable plate 18. It is the structure which constitutes a station keeping means from support shaft 18B which the structure which supports a movable plate 18 illustrates, and bearing 30, And combination with the point which constituted the driving means to which the seesaw movement of the movable plate 18 is carried out from lower electrode 22A-1 of the pair installed on the substrate 11, 22A-2 and 22B-1, and 22B-2 is not limited. That is, that it is applicable to the accumulation mold microswitch of all the structures mentioned above can understand easily the structure of the traveling contacts 16A and 16B shown in drawing 48 .
[0090]
[Effect of the Invention] As explained above, according to this invention, a movable plate 18 is the structure of carrying out a seesaw movement and making between stationary-contact 13A and 13B and between 14A and 14B attaching and detaching electrically, and movable-plate 18 the very thing does not carry out elastic deformation. For this reason, there is no possibility of 18 movable plate of having breakage accident, and the advantage which can offer the high accumulation mold microswitch of endurance is acquired. Moreover, since the weight is mainly supported with the stanchion 15, when a movable plate 18 uses a hinge as a station keeping means 19 of a movable plate 18, a hinge should just maintain the location of a movable plate 18. Therefore, since reinforcement is not required of a hinge, elastic deformation can make in an easy configuration. Moreover, though it carries out movable [of the movable plate 18] according to the force of static electricity, since the spring force by the hinge can be made small, big contact pressure can be given to stationary contacts 13A, 13B, 14A, and 14B, and a stable contact condition can be acquired.
[0091] Moreover, in this invention, the configuration which used support shaft 18B and bearing 30 as a station keeping means 19 of a movable plate 18 was proposed. When carrying out a seesaw movement by the force of static electricity, it can be made to operate with a still smaller suction force, since reaction force does not occur at all to the seesaw movement of a movable plate 18 when it considers as the configuration using this bearing 30. Moreover, the advantage which can maintain to stability the condition of having contacted to the stationary contact is acquired. moreover, the electromagnetism by this invention -- according to the microswitch of a drive mold, since the driving torque of a movable plate 18 can be acquired greatly, the contact condition stabilized further in this case can be acquired.
[0092] Since adsorption power can be strengthened further further when it considers as the structure using an exiting coil 62, as shown especially in drawing 33 thru/or drawing 43 , the big advantage which can stabilize the contact condition of a switch is acquired. Furthermore, in this invention, since it considered as the microstrip line structure in which impedance matching was able to take stationary contacts 13A, 13B, 14A, and 14B, it can stabilize and transmit, without degrading wave quality also by the RF signal, and the advantage which can carry out intermittence control of the RF signal in low loss and high separation loss is acquired.
[0093] Moreover, since the accumulation mold microswitch by this invention can be manufactured with a micro machine technique, it is small, and the advantage which can make the product of high quality so much and cheaply is also acquired.

[Translation done.]

DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]
[Drawing 1] The top view for explaining one example of the accumulation mold microswitch proposed by claims 1 or 2 of this invention.
[Drawing 2] The sectional view on the A-A line shown in drawing 1 .
[Drawing 3] The electric representative circuit schematic of the accumulation mold microswitch of the structure shown in drawing 1 and drawing 2 .
[Drawing 4] The perspective view for explaining the structure of the whole accumulation mold microswitch shown in drawing 1 and drawing 2 .
[Drawing 5] Process drawing for explaining the manufacture approach of the accumulation mold microswitch shown in drawing 1 and drawing 2 .
[Drawing 6] The top view for explaining the deformation example of the accumulation mold microswitch shown in drawing 1 and drawing 2 .
[Drawing 7] The sectional view on the B-B line of drawing 6 .
[Drawing 8] The representative circuit schematic of the accumulation mold microswitch shown in drawing 6 and drawing 7 .
[Drawing 9] The top view for explaining the deformation example of further others of the accumulation mold microswitch shown in drawing 1 and drawing 2 .
[Drawing 10] The sectional view on the C-C line shown in drawing 9 .
[Drawing 11] The representative circuit schematic of the accumulation mold microswitch shown in drawing 9 and drawing 10 .
[Drawing 12] The top view for explaining the example of further others of the accumulation mold microswitch shown in drawing 1 and drawing 2 .
[Drawing 13] The sectional view on D-D line shown in drawing 12 .
[Drawing 14] The top view for explaining the example of the accumulation mold microswitch proposed by claim 3 of this invention.
[Drawing 15] The sectional view on the E-E line shown in drawing 14 .
[Drawing 16] The sectional view showing the deformation example of the example shown in drawing 14 .
[Drawing 17] Process drawing for explaining the manufacture approach of the accumulation mold microswitch shown in drawing 14 and drawing 15 .
[Drawing 18] The sectional view showing the deformation example of the accumulation mold microswitch shown in drawing 14 .
[Drawing 19] The sectional view showing the deformation example of further others of the accumulation mold microswitch shown in drawing 14 .
[Drawing 20] The top view for explaining the example of the accumulation mold microswitch proposed by claim 4 of this invention.
[Drawing 21] The sectional view on the F-F line shown in drawing 20 .
[Drawing 22] The top view for explaining the example of the accumulation mold microswitch proposed by claim 11 of this invention.
[Drawing 23] The sectional view on the G-G line shown in drawing 22 .
[Drawing 24] The top view showing the example which combined the example shown in drawing 22 , and the example shown in drawing 20 .
[Drawing 25] The sectional view for explaining the manufacture approach of the example shown in drawing 22 .

[Drawing 26] The sectional view for explaining a continuation of the manufacture approach shown in drawing 25 .
[Drawing 27] The sectional view for explaining a continuation of the manufacture approach shown in drawing 25 and drawing 26 .
[Drawing 28] The top view for carrying out supplementary information of the process shown in drawing 26 A.
[Drawing 29] The top view for carrying out supplementary information of the process shown in drawing 26 A.
[Drawing 30] The top view for explaining the example of the accumulation mold microswitch proposed by claim 5 of this invention.
[Drawing 31] The sectional view on the H-H line shown in drawing 30 .
[Drawing 32] The top view for explaining the deformation example of the accumulation mold microswitch shown in drawing 30 .
[Drawing 33] The top view for explaining the example of the accumulation mold microswitch proposed by claim 6 of this invention.
[Drawing 34] The sectional view which looked at drawing 33 from the flank.
[Drawing 35] Process drawing for explaining the manufacture approach of the accumulation mold microswitch shown in drawing 33 and 34.
[Drawing 36] The perspective view showing an example of the exiting coil used for the accumulation mold microswitch shown in drawing 33 and drawing 34 .
[Drawing 37] The top view for explaining the condition of having loaded the hole formed in the substrate with the exiting coil shown in drawing 36 .
[Drawing 38] The top view for explaining the deformation example of the accumulation mold microswitch shown in drawing 33 and drawing 34 .
[Drawing 39] The sectional view for explaining the structure of the accumulation mold microswitch shown in drawing 38 .
[Drawing 40] The sectional view for explaining the example of the accumulation mold microswitch proposed by claim 18 of this invention.
[Drawing 41] The sectional view showing the example of the accumulation mold microswitch proposed by claim 19 of this invention.
[Drawing 42] The sectional view for [of the example shown in drawing 33 and drawing 34] explaining the example further.
[Drawing 43] The top view which looked at drawing 42 from the upper part.
[Drawing 44] The top view for explaining the example of the accumulation mold microswitch proposed by claim 1 of this invention.
[Drawing 45] The switch representative circuit schematic shown in drawing 33 .
[Drawing 46] The top view for explaining the example of the accumulation mold microswitch of this invention.
[Drawing 47] The sectional view for explaining the example of the accumulation mold microswitch of this invention.
[Drawing 48] The perspective view for explaining the deformation example of further others of this invention.
[Drawing 49] The perspective view for explaining a Prior art.
[Drawing 50] The sectional view on the I-I line shown in drawing 49 .
[Description of Notations]
11 Substrate
12 12' Insulating layer
13A, 13B Stationary contact
14A, 14B Stationary contact
15 Stanchion
16A, 16B Traveling contact
17 Wiring
18 Movable Plate
18A Through tube

18B Support shaft
19 Station Keeping Means
21 Polar Zone
21A Pedestal
22A, 22B Lower electrode
23A, 23B Terminal area
24 Common Potential Layer
25 Resin Layer (1st Sacrifice Layer)
26 Insulating Layer
28A, 28B Up electrode
29 Resin Layer (2nd Sacrifice Layer)
30 Bearing
31 Base
32 Arch
62 Exiting Coil
62A Magnetic core
62B Coil
62C Coil electrode
64 Resin Layer
65 Wiring
66 Electrode

[Translation done.]

DRAWINGS

[Drawing 2]

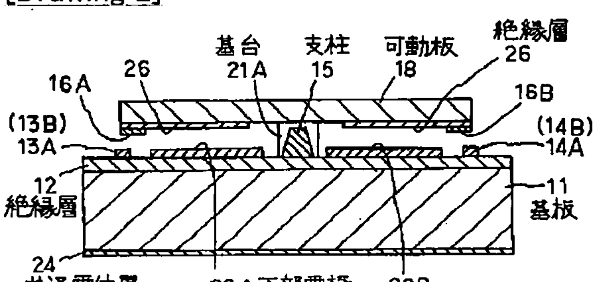


図2

[Drawing 3]

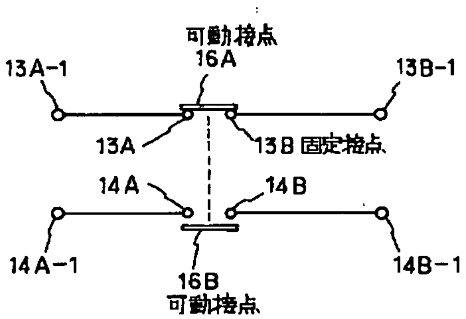


図 3

[Drawing 1]

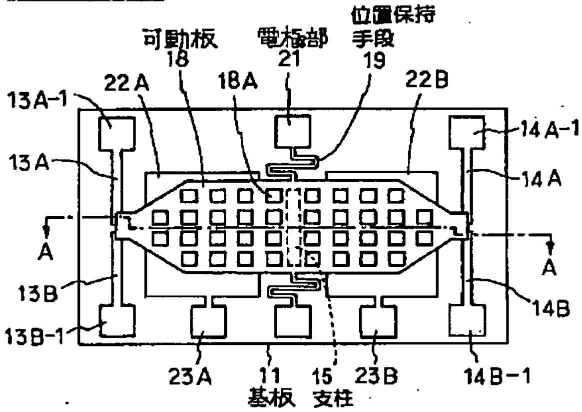
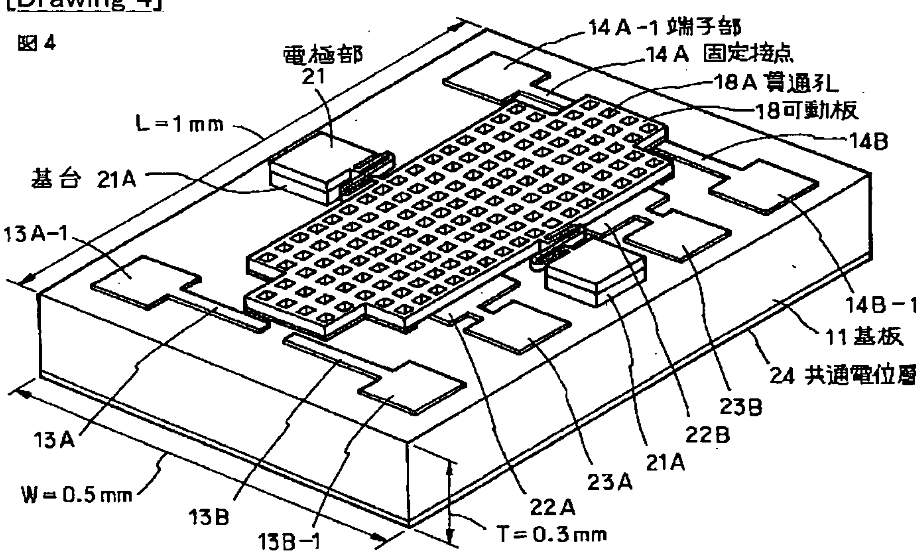


図 1

[Drawing 4]

図 4



[Drawing 6]

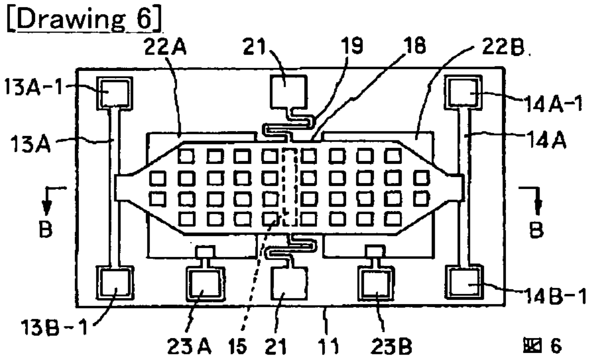


図 6

[Drawing 7]

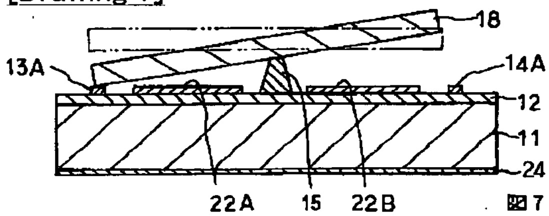


図7

[Drawing 8]

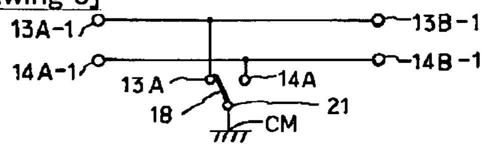


図8

[Drawing 5]

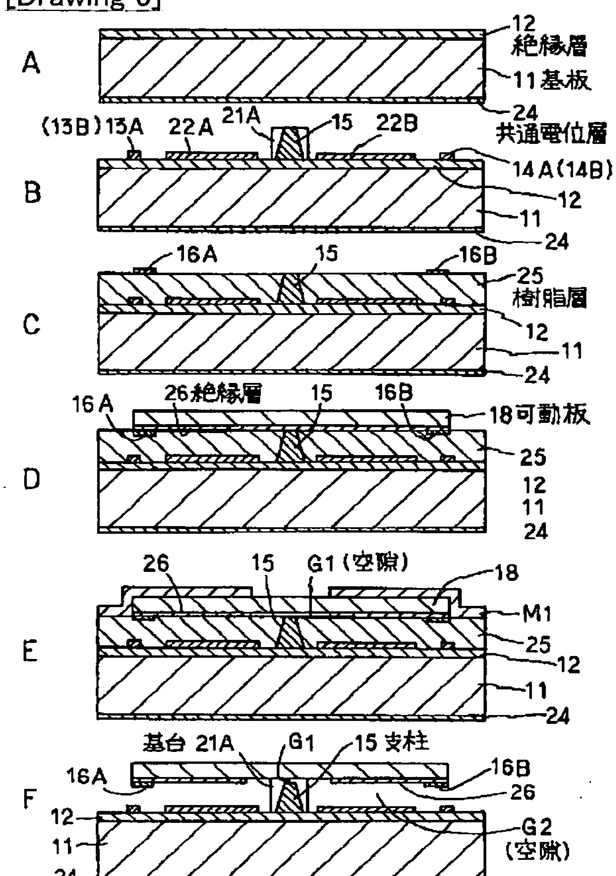


図5

[Drawing 9]

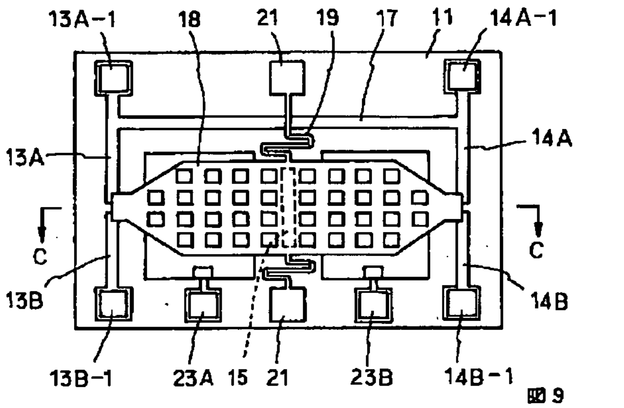


図9

[Drawing 10]

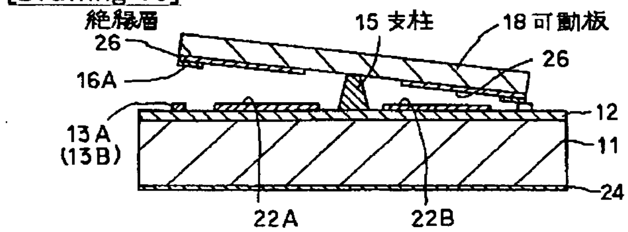


図10

[Drawing 11]

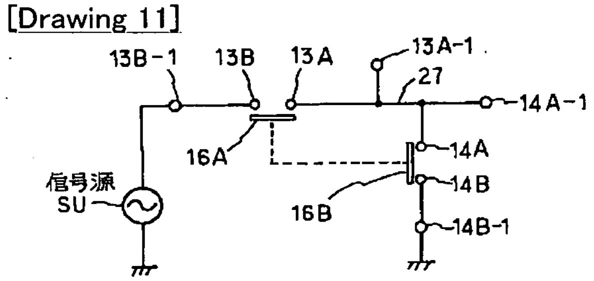


図11

[Drawing 12]

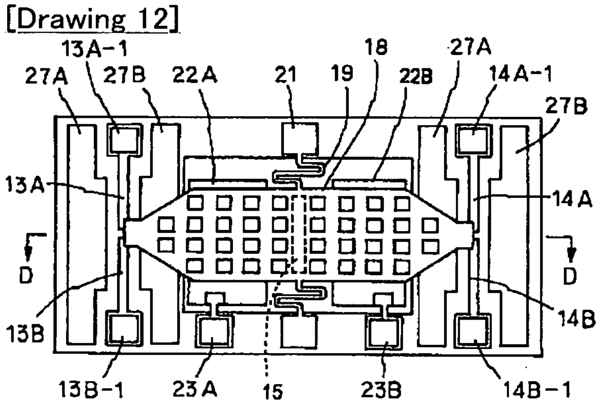


図12

[Drawing 13]

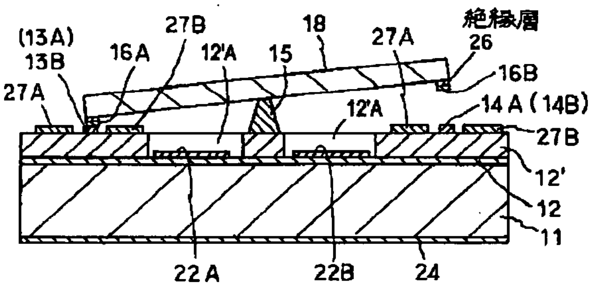


図13

[Drawing 18]

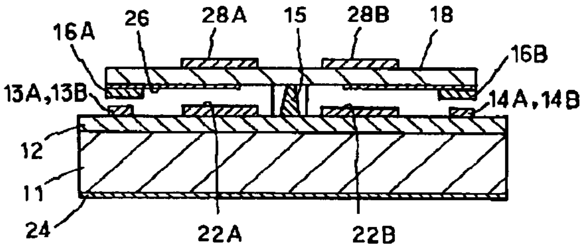


図18

[Drawing 14]

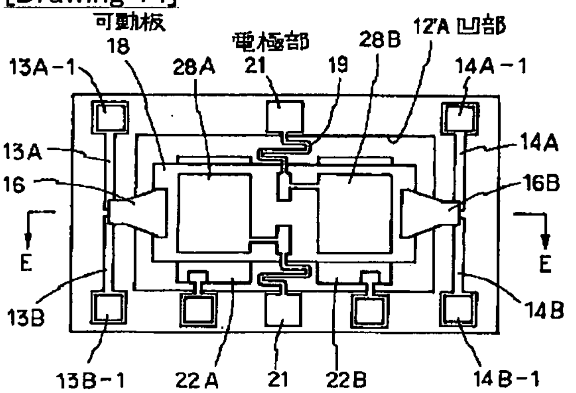


図14

[Drawing 15]

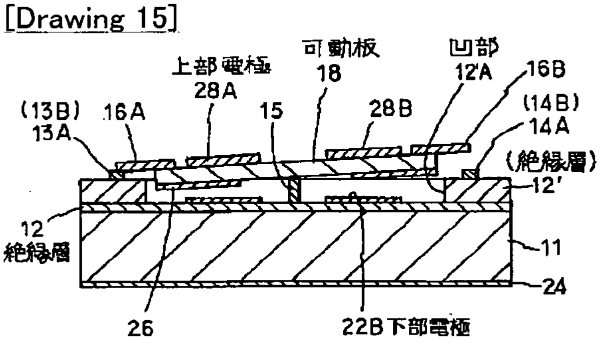


図15

[Drawing 16]

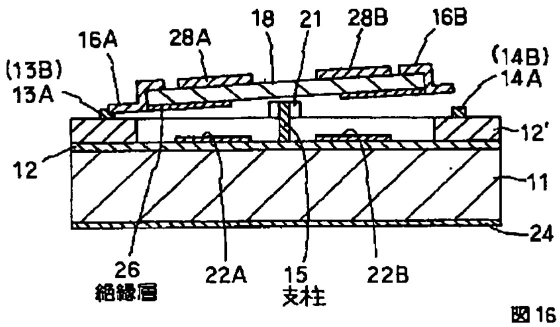


図16

[Drawing 17]

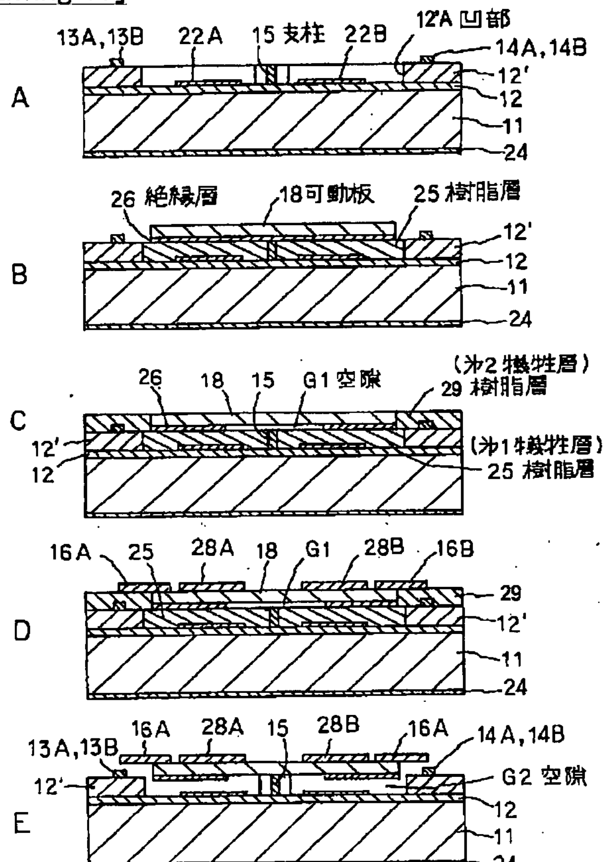


図17

[Drawing 21]

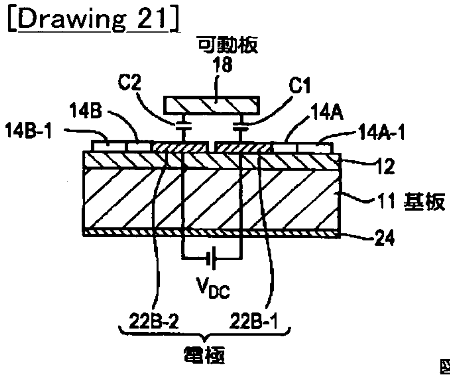


図21

[Drawing 19]

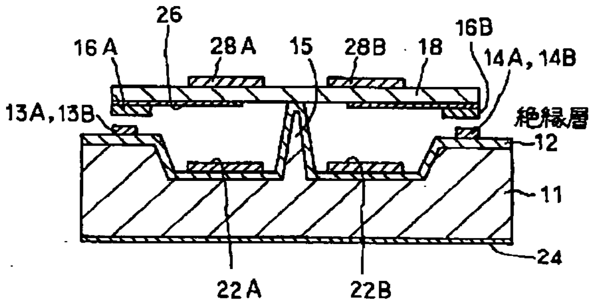


図 19

[Drawing 20]

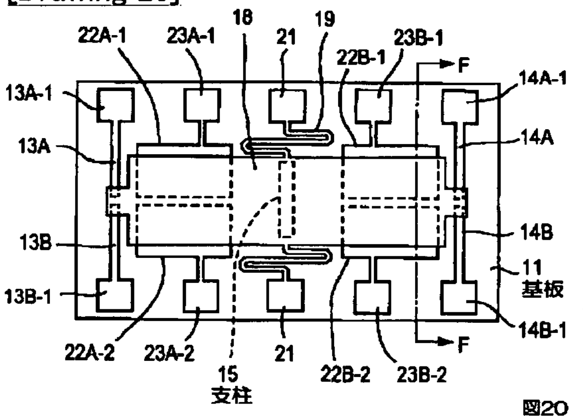


図20

[Drawing 22]

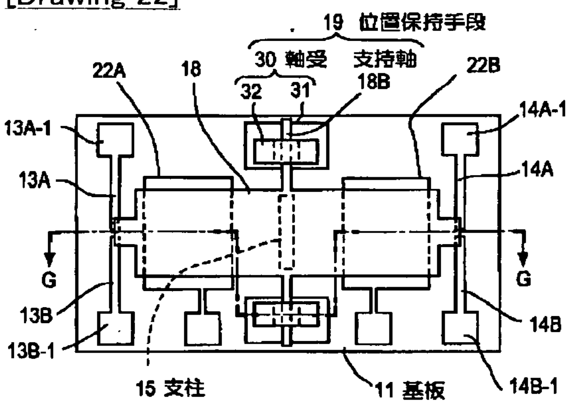


図22

[Drawing 23]

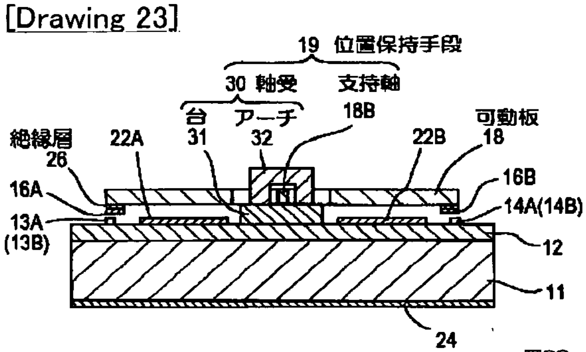


図23

[Drawing 24]

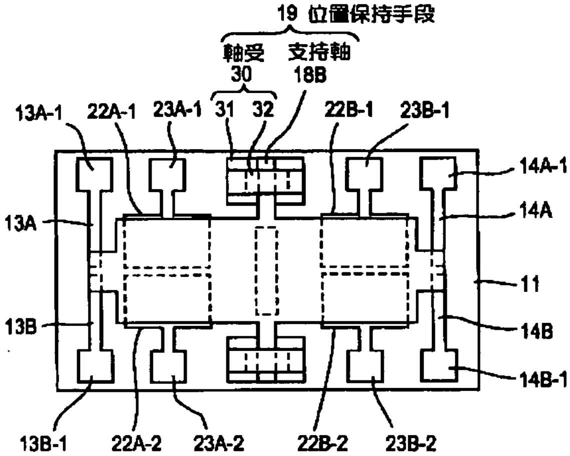


図24

[Drawing 28]

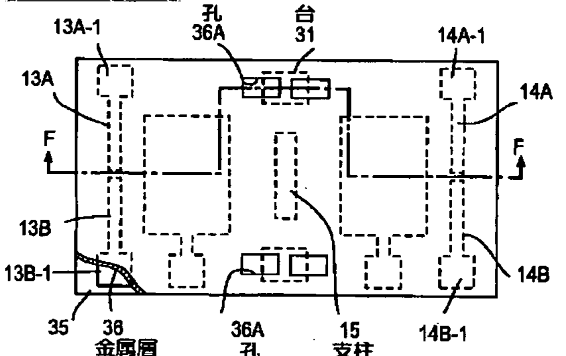


図28

[Drawing 25]

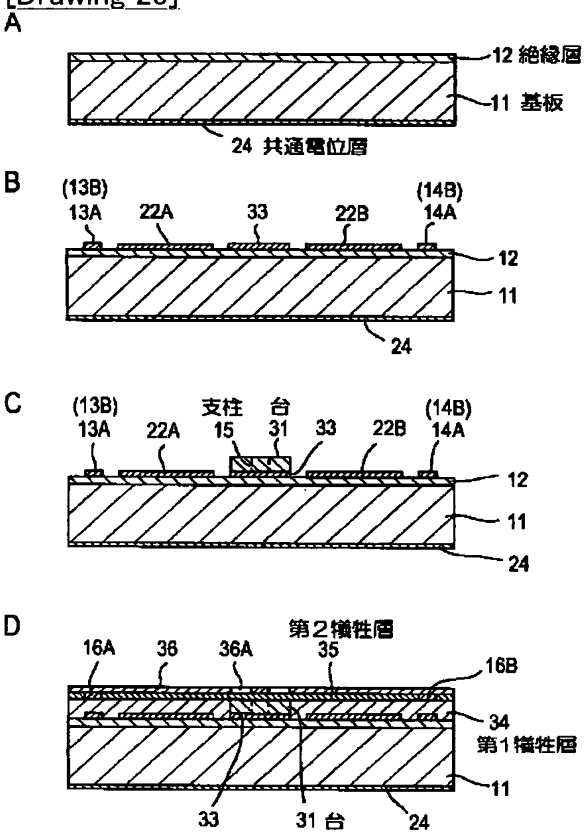


図25

[Drawing 26]

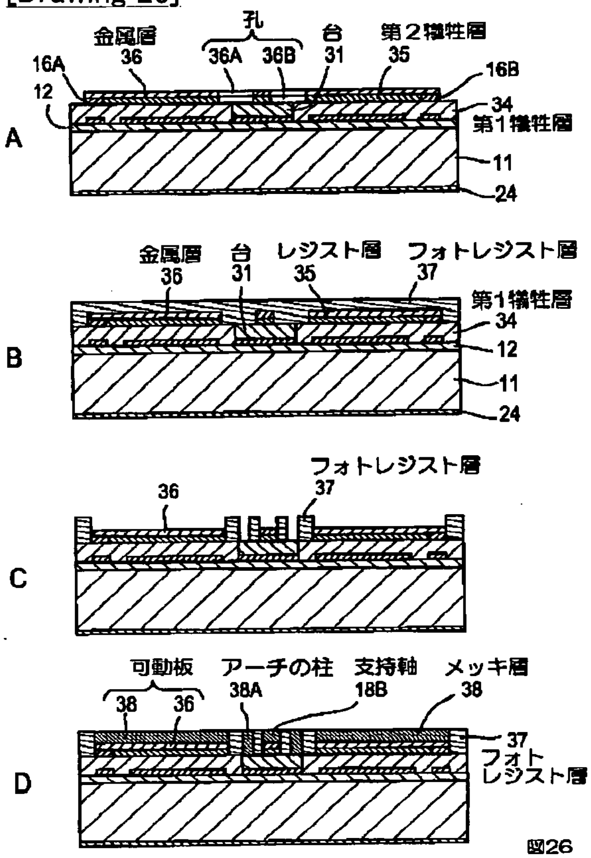


図26

[Drawing 29]

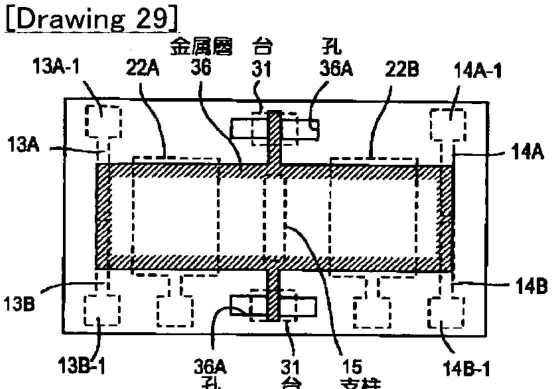


図29

[Drawing 30]

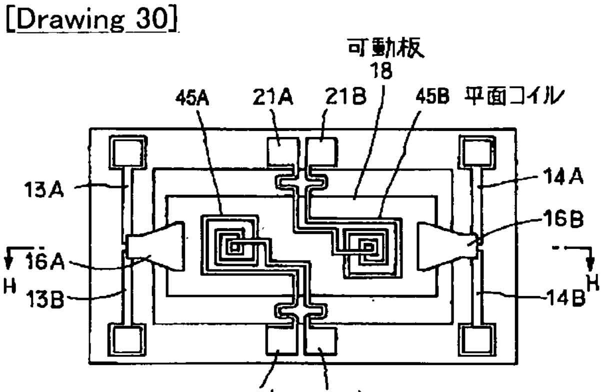


図30

[Drawing 45]

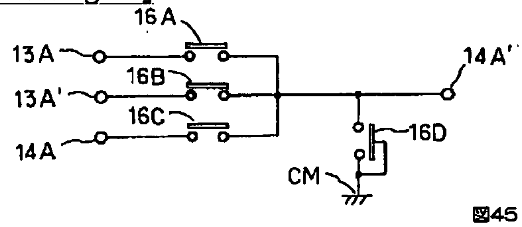


図45

[Drawing 27]

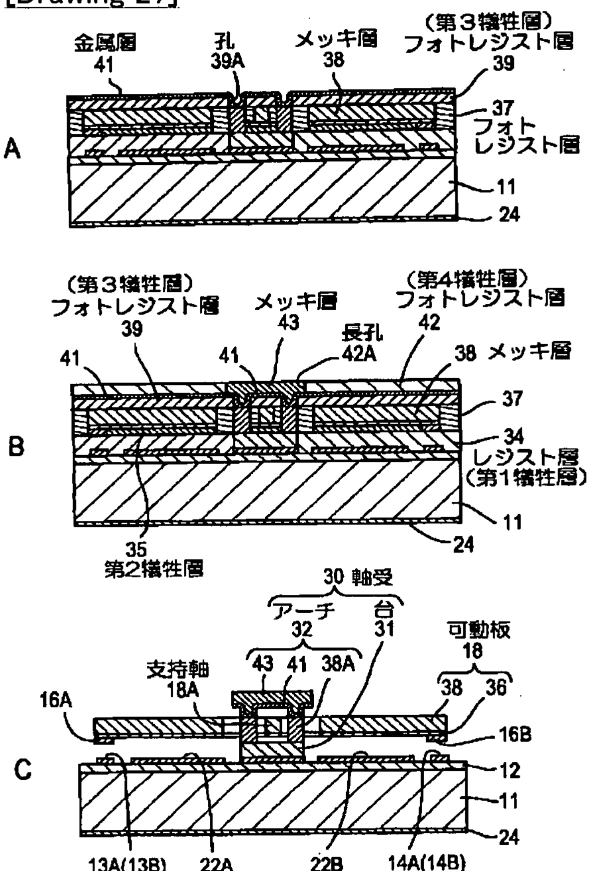


図27

[Drawing 31]

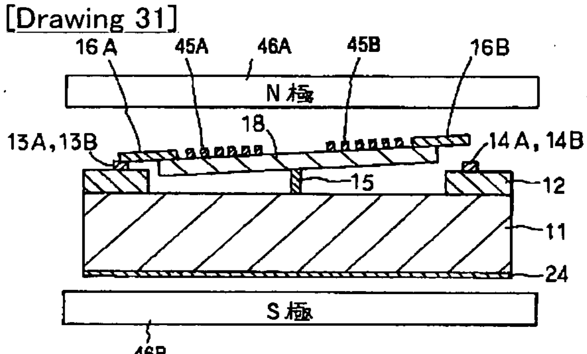


図31

[Drawing 32]

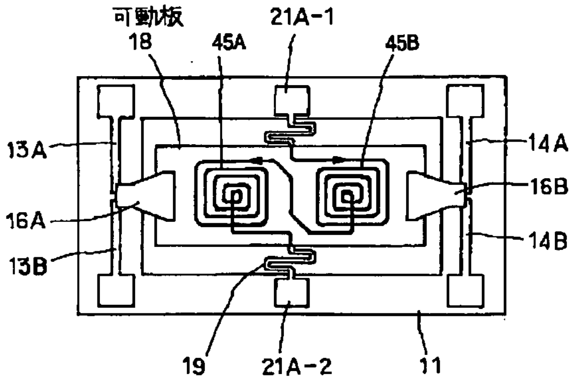


図32

[Drawing 33]

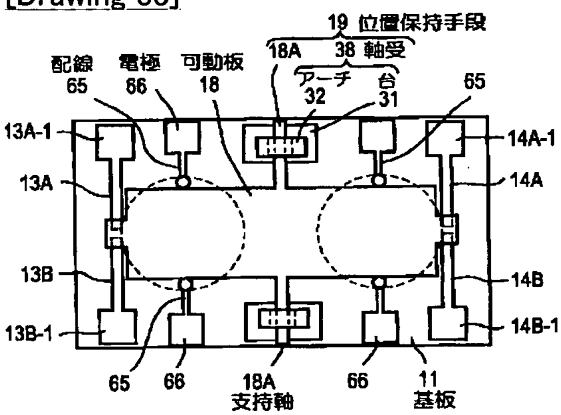


図33

[Drawing 34]

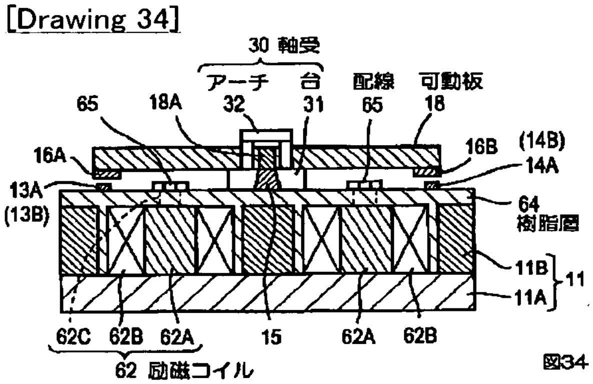


図34

[Drawing 35]

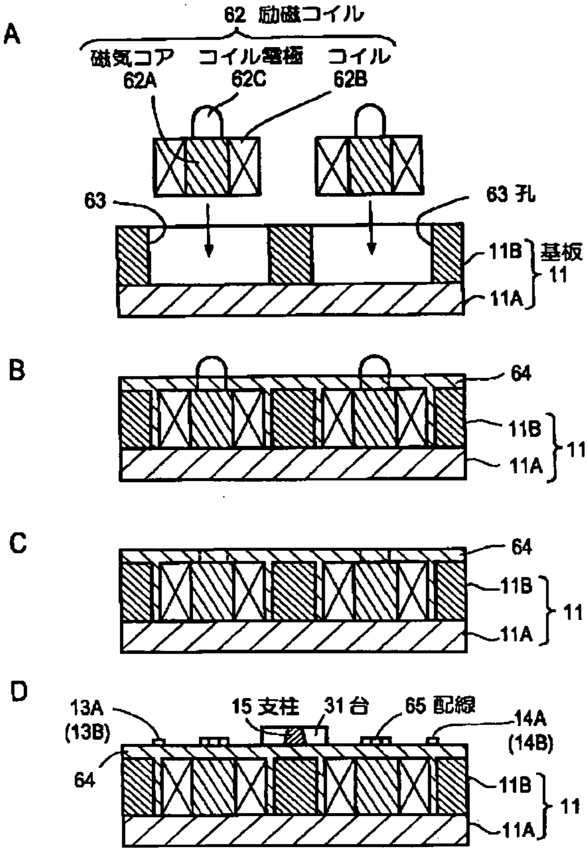


図35

[Drawing 36]

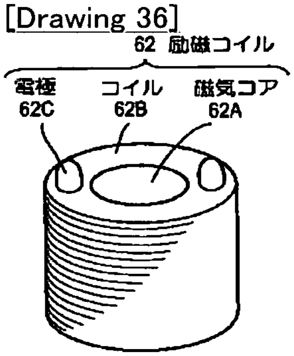


図36

[Drawing 37]

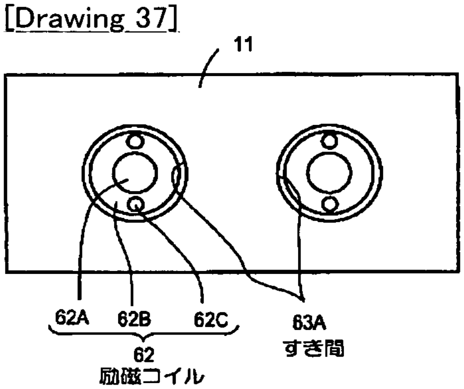


図37

[Drawing 38]

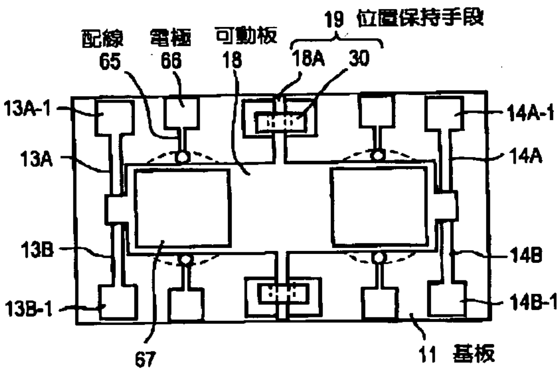


図38

[Drawing 39]

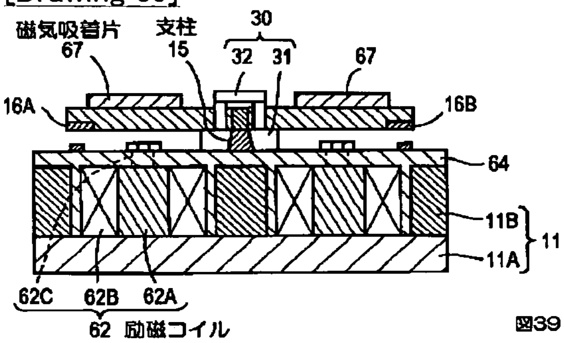


図39

[Drawing 40]

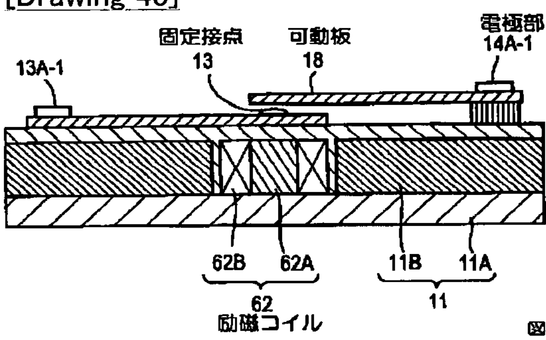


図40

[Drawing 41]

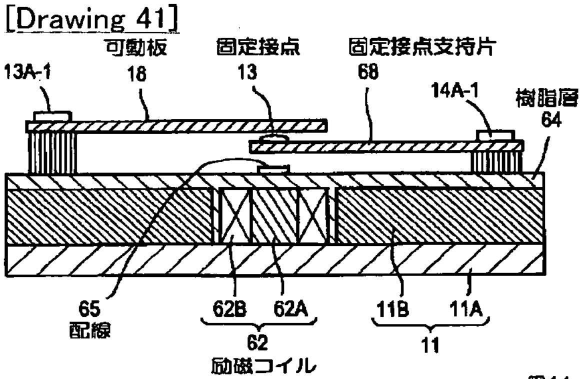


図41

[Drawing 42]

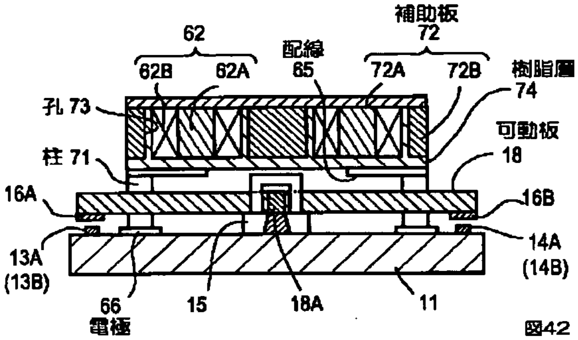


図42

[Drawing 43]

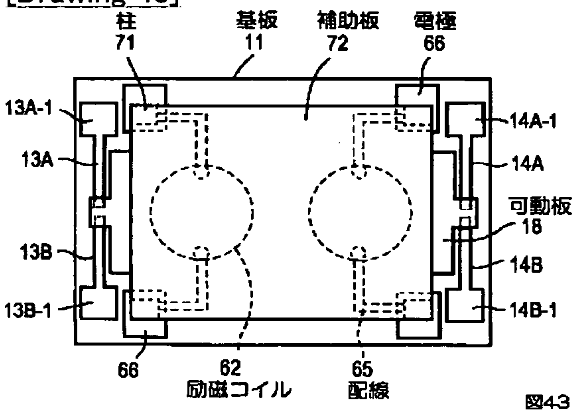


図43

[Drawing 44]

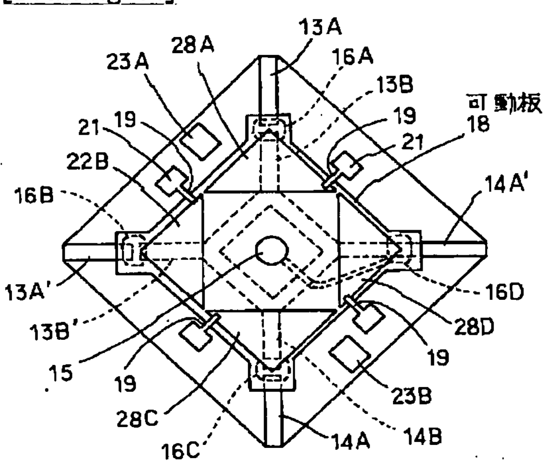


図44

[Drawing 46]

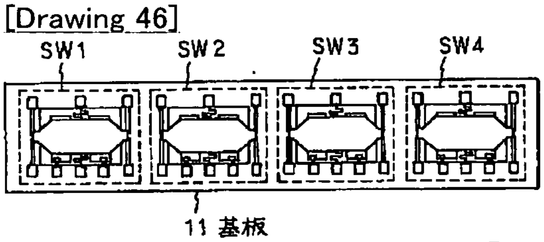


図46

[Drawing 50]

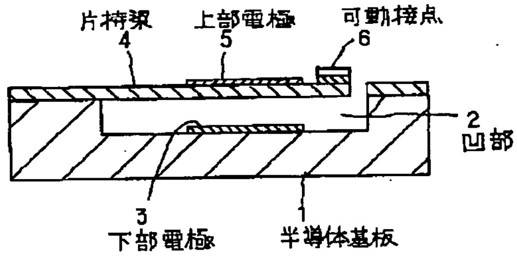


図50

[Drawing 47]

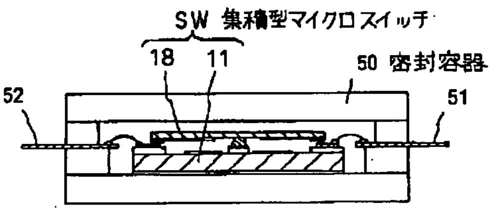
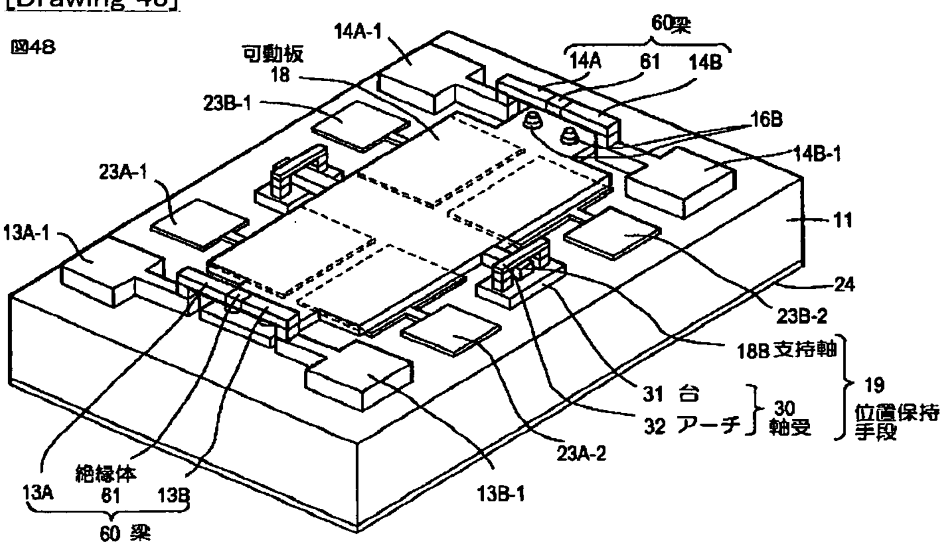


図47

[Drawing 48]

図48



[Drawing 49]

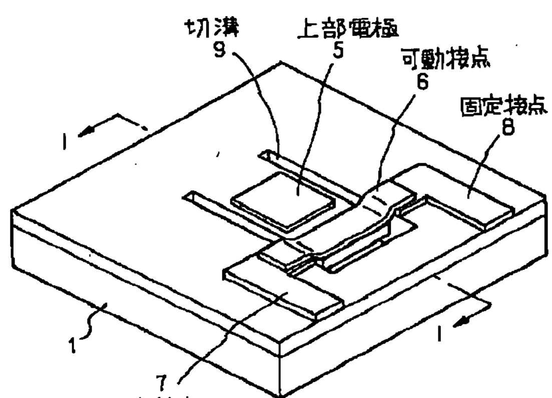


図49

[Translation done.]